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A
KEY

TO

F. WALKINGAME'S

TUTOR'S ASSISTANT,

CONTAINING THE

SOLUTIONS OF THE QUESTIONS

IN THAT WORK;

With the REFERENCES as they stand in the LAST edition of that
book printed for WILSON, SPENCE, and MAWMAN, York.

To which is added,

Some useful Rules, &c.

By T. CROSBY.

Take away Arithmetic, which is the art by which we come to the knowledge of
weight and measure, and all that remains is base and of no estimation. PLATO.

YORK:

Printed by and for WILSON, SPENCE, and MAWMAN,

Anno 1797.

W E B

MEMORANDUM

OF THE

PROCEEDINGS

OF THE

BOARD

Entered at Stationers' Hall.

Printed by J. W. Smith, at the Press of the Stationers' Company, in the Strand.

1850

W E B

W E B

Printed by J. W. Smith, at the Press of the Stationers' Company, in the Strand.

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ADVERTISEMENT.

THE extensive sale of WALKINGAME'S ARITHMETIC, is an incontrovertible proof of its merit. Edition after edition has been so repeatedly required, as to occasion (by the hurry of printing, the inattention of compositors, or the unprecedented demand of the public) a variety of copies, distinguishable only for the errors with which they abound. Conceiving that such a work thoroughly corrected by an experienced arithmetician, and as attentively revised by a careful typographer, would be highly acceptable, the publishers of this book have lately given to the world an edition of the TUTOR'S ASSISTANT, which they trust will be generally adopted in the principal seminaries of learning throughout the kingdom. In the Preface to that publication, they signi-

fied their intention of offering a "KEY TO WALKINGAME'S ARITHMETIC," which they now submit to the public, and trust it will be found an useful and acceptable supplement to the very meritorious and popular work it is intended to illustrate.

With the assistance of the present undertaking it is presumed, that such persons as cannot have the instructions of an experienced teacher, will be able to improve themselves; the diffident master of a juvenile academy, will have a certain criterion on which he may depend; and the more practised and perfect arithmetician will avoid the labour and consequent loss of time in working the sum of each of his scholars.

Mr. CROSBY of York, who has long made the mathematics his peculiar study, has afforded the publishers hereof an opportunity of offering to the public the CORRECTED edition of the Tutor's Assistant, and

and also this "KEY." He has bestowed such attention on both, as he hopes will insure them the approbation of his fellow-labourers and their pupils. He has endeavoured to keep the solutions free from ambiguity, and has added Explanatory Remarks where he thought any thing was not sufficiently obvious. On the Extraction of Roots he has taken more than ordinary pains; and he is indebted to the Diary of Mr. Burrowes and the Works of Mr. Moody for the rules he has inserted for performing the Square and Cube Roots.

He has only to add, that no copy of Walkingame's Arithmetic contains references to this Key except the last edition printed for

WILSON, SPENCE, and MAWMAN, YORK.

Every sum therein he has worked anew, and believes the whole to be completely accurate. It must not be expected therefore that this book can answer to any other

other edition whatever. Such persons as wish to honour EITHER with their patronage, are requested to be particular in giving orders for

WALKINGAME'S ARITHMETIC CORRECTED,
OR

THE KEY, COMPILED BY T. CROSBY,
AND PUBLISHED BY

WILSON, SPENCE, and MAWMAN, YORK.

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EXPLANATION

OF THE

CHARACTERS made Use of in this Key.

- \equiv *Equal.* The Sign of Equality; as, 4 qrs. \equiv 1 cwt. signifies, that 4 qrs. are equal to 1 cwt.
- $-$ *Minus or less.* The Sign of Subtraction; as, $8-2=6$; that is, 8 lessened by 2 is equal to 6.
- $+$ *Plus or more.* The Sign of Addition; as, $4+4=8$; that is, 4 added to 4 more is equal to 8.
- \times *Multiplied by.* The Sign of Multiplication; as, $4 \times 6=24$; that is, 4 multiplied by 6 is equal to 24.
- \div *Divided by.* The Sign of Division; as, $8 \div 2=4$; that is, 8 divided by 2 is equal to 4.
- $\frac{2357}{63}$ Numbers placed like a fraction, do likewise denote Division; the upper number being the dividend, and the lower the divisor.
- $::$ *So is.* The Sign of Proportion; as, $2:4::8:16$ that is, as 2 is to 4 so is 8 to 16.
- $\overline{7-2}+5=10$ Shews that the difference between 2 and 7 added to 5 is equal to 10.
- $9-\overline{2+5}=2$ Signifies, that the sum of 2 and 5 taken from 9 is equal to 2.
- $\sqrt{\quad}$ Prefixed to any number, signifies the Square Root of that number is required.
- $\sqrt[3]{\quad}$ Signifies the Cube, or third power.
- $\sqrt[4]{\quad}$ Denotes the Biquadrate, or the fourth power, &c.
- i. e.* *id. est,* that is.

KEY

KEY

TO THE TUTOR'S ASSISTANT.

PART I.

NUMERATION.

Words expressed in figures.

(¹) 23 (²) 254 (³) 3204 (⁴) 25856 (⁵) 132245
 (⁶) 4941400 (⁷) 27157832 (⁸) 722231504
 (⁹) 602210500.

Numbers expressed in words.

- (¹⁰) Thirty-five.
- (¹¹) Fifty-nine.
- (¹²) One hundred and seventy-two.
- (¹³) Two thousand and sixteen.
- (¹⁴) Five thousand, two hundred and one.
- (¹⁵) Twenty thousand, seven hundred and sixty.
- (¹⁶) Five hundred, nineteen thousand and seven.
- (¹⁷) Seven hundred, fifty thousand and fifty-eight.
- (¹⁸) Five millions, nine hundred thousand and thirty.
- (¹⁹) Five millions, two hundred and four thousand and fifty-four.
- (²⁰) Two millions, seventy-one thousand, nine hundred and nine.
- (²¹) Seventy millions, fifty-four thousand and eight.
- (²²) Sixty-five millions, seven hundred thousand and forty-seven.
- (²³) Ninety millions, six thousand one hundred and fifty-seven.

(²⁴) Two hundred and one million nine hundred thousand, seven hundred and ninety.

ADDITION OF INTEGERS.

(¹) 44 (²) 331 (³) 3054 (⁴) 33566 (⁵) 37525 (⁶) 344978.

HERE in the second example, beginning with unit's column, say 4 and 7 are 11, and 9 make 20, and 6, 26, and 1, 27, and 5, 32, and 7, 39, and 5, 44, and 7, 51; we set down the overplus 1 and carry 5 for the five tens to the next column, which, on casting up, we find amounts to 33, and as there are no more columns, we place down 33 accordingly, and so the whole sum is 331. The very same method must be observed in the other examples.

SUBTRACTION OF INTEGERS.

(¹) 117 (²) 2029 (³) 7991 (⁴) 105089 (⁵) 118767
(⁶) 1600041.

HERE in the first example, we say 4 from 1 we cannot take, but borrowing 10 to put to it becomes 11, from which take 4, the remainder is 7; then we carry 1 to 5, and so it becomes 6, which take from 7, and there rests 1; again take 1 from 2 there rests 1; each of which remainders we write down under its proper figure, and the whole remainder is 117; and so for any other.

MULTIPLICATION OF INTEGERS.

CASE I.

(¹) 50209472 (²) 157413063 (³) 31701750084
(⁴) 135520535 (⁵) 1386222 (⁶) 49437682
(⁷) 29784832 (⁸) 37929654 (⁹) 27010470
(¹⁰) 341441881 (¹¹) 35210472.

CASE II.

(¹²) 14131716 (¹³) 20429008 (¹⁴) 33266050 (¹⁵) 552342990

$$\begin{array}{r} 4710572 \\ \underline{61237436} \end{array}$$

$$\begin{array}{r} 5107252 \\ \underline{71501528} \end{array}$$

$$\begin{array}{r} 6653210 \\ \underline{99798150} \end{array}$$

$$\begin{array}{r} 92057165 \\ \underline{1472914640} \end{array}$$

 (¹⁶) 43762047

(¹⁶) 43762047	(¹⁷) 73722592	(¹⁸) 23142069	(¹⁹) 32328936
<u>6251721</u>	<u>9215324</u>	<u>2571341</u>	<u>3592104</u>
<u>106279257</u>	<u>165875832</u>	<u>48855479</u>	<u>68249976</u>

CASE III.

(²⁰) 1897287	(²¹) 160520	(²²) 13552160	(²³) 27501976
<u>542082</u>	<u>64208</u>	<u>18973024</u>	<u>192513832</u>
<u>7318107</u>	<u>802600</u>	<u>8131296</u>	<u>55003952</u>
		<u>1016412000</u>	<u>7453035496</u>

CASE IV.

(²⁴) 5140836	(²⁵) 142086500	(²⁶) 158132820
<u>3998428</u>	<u>49730275</u>	<u>47439846</u>
<u>1142408</u>	<u>35521625</u>	<u>26355470</u>
<u>15427648836</u>	<u>405088611500</u>	<u>3110103592820</u>

CASE V.

(²⁷) 1626	(²⁸) 15180	(²⁹) 530	(³⁰) 1722
<u>542</u>	<u>26565</u>	<u>1855</u>	<u>3444</u>
<u>1355</u>	<u>7590</u>	<u>1908000000</u>	<u>301620000</u>
<u>1425460000</u>	<u>103983000000</u>		

CASE VI.

(³¹) 771039	(³²) 921563	(³³) 715241
$7 \times 5 = 35$	$4 \times 8 = 32$	$7 \times 8 = 56$
<u>5397473</u>	<u>3686252</u>	<u>5006587</u>
<u>5</u>	<u>8</u>	<u>8</u>
<u>26986365</u>	<u>29490016</u>	<u>40053496</u>

NOTE I. As Multiplication is but a compendious method of performing a manifold addition of the same number, we do not think it necessary to add any explanatory remarks to any of the above examples, but shall rather give the following methods of contractions, which will be found of infinite use in performing many of the examples with half the trouble and half the figures which are required by the common methods.

When in the multiplier some two or more adjacent figures

are equal to some multiple of another figure therein, the operation may be abbreviated by multiplying first by that other figure, and then that product by the figure which denotes the multiple, and adding the product together, having placed them so that the first figure of each row or product, may stand under the first figure of those in the multiplier, whose product by the multiplicand such row denotes.

EXAMPLE 1.

$$\begin{array}{r}
 \text{Multiply} \quad 408765 \\
 \text{By} \quad \quad \quad 3612 \\
 \hline
 \quad \quad \quad 4905180 \\
 \quad \quad 14715540 \\
 \hline
 \text{Product} \quad 1476459180
 \end{array}$$

EXAMPLE 2.

$$\begin{array}{r}
 \text{Multiply} \quad 4675231 \\
 \text{By} \quad \quad \quad 324981 \\
 \hline
 \quad \quad \quad 42077079 \\
 \quad \quad 378693711 \\
 \hline
 \quad 1514774844 \\
 \hline
 \text{Product} \quad 1519362245611
 \end{array}$$

In the first of these examples we begin with multiplying by 12, and then we multiply that product by 3; because 3 times 12 are equal to the next two figures 36, we place the products down as above, and their sum is the whole product required. The other is performed in the same manner.

NOTE 2. When the multiplier consists of any number of nines; place as many cyphers on the right of the multiplicand as there are nines in the multiplier, from which subtract the multiplicand, and the remainder is the product required.

EXAMPLE.

$$\begin{array}{r}
 \text{Multiply} \quad 37674658 \\
 \text{by} \quad \quad \quad 999 \\
 \hline
 \quad \quad \quad 37674658000 \\
 \text{Subtract} \quad \quad 37674658 \\
 \hline
 \text{Product} \quad 37636983442
 \end{array}$$

Here, by adding the cyphers, the multiplier is made one too much, and when one is the multiplier the product is evidently the multiplicand, whence the truth of this contraction is manifest.

DIVISION

DIVISION OF INTEGERS.

CASE I.

- | | | |
|----------------|-----------------|---------------|
| (1) 362553-1. | (2) 240490-2. | (3) 1802604. |
| (4) 1440657-2. | (5) 871839-3. | (6) 333243. |
| (7) 318415-5. | (8) 2783145-1. | (9) 275001-2. |
| (10) 246410-3. | (11) 2258394-4. | |

HERE, in the first example, we say how oft 2 in 7; the answer is 3 times, for 3 times 2 is 6, and consequently there remains 1, which carried to the next (2) of the dividend, they make 12; then say how oft 2 in 12; the answer is 6. Again, the twos in 5 are 2, and 1 remains; then the twos in 11 are 5, and 1 remains; and the twos in 10 are 5, and nothing remains; also the twos in 7 are 3, and 1 remains, which placed at the end of the quotient, with a dash between, the whole quotient is 362553-1. The other examples are done after the same manner.

CASE II.

Div.	Divid.	Quot.	Div.	Divid.	Quot.
(12) 29	4172377	(143875.	(13) 37	7210473	(194877.
<u>29</u>			<u>37</u>		
127			351		
<u>116</u>			<u>333</u>		
112			180		
<u>87</u>			<u>148</u>		
253			324		
<u>232</u>			<u>206</u>		
217			287		
<u>203</u>			<u>259</u>		
147			283		
<u>145</u>			<u>259</u>		
Rem. 2			Rem. 24		

$$(^{14}) 473 \overline{) 2104721} (4449.$$

$$\begin{array}{r} 1892 \\ \hline 2127 \\ 1892 \\ \hline 2352 \\ 1892 \\ \hline 4601 \\ 4257 \\ \hline 344 \\ \hline \hline \end{array}$$

$$(^{15}) 275 \overline{) 3720147} (13527.$$

$$\begin{array}{r} 275 \\ \hline 970 \\ 825 \\ \hline 1451 \\ 1375 \\ \hline 764 \\ 550 \\ \hline 2147 \\ 1925 \\ \hline 222 \\ \hline \hline \end{array}$$

$$(^{16}) 3701 \overline{) 72109521} (19483.$$

$$\begin{array}{r} 3701 \\ \hline 35099 \\ 33309 \\ \hline 17905 \\ 14804 \\ \hline 31012 \\ 29608 \\ \hline 14041 \\ 11103 \\ \hline 2938 \\ \hline \hline \end{array}$$

$$(^{17}) 3576 \overline{) 72104725} (20163.$$

$$\begin{array}{r} 7152 \\ \hline 5847 \\ 3576 \\ \hline 22712 \\ 21456 \\ \hline 12565 \\ 10728 \\ \hline 1837 \\ \hline \hline \end{array}$$

$$(^{18}) 2510 \overline{) 63210476} (25183. \quad (^{19}) 25204 \overline{) 321047217} (12737$$

$$\begin{array}{r} 5020 \\ \hline 13010 \\ 12550 \\ \hline 4604 \\ 2510 \\ \hline 20947 \\ 20080 \\ \hline 8676 \\ 7530 \\ \hline 1146 \\ \hline \hline \end{array}$$

$$\begin{array}{r} 25204 \\ \hline 69007 \\ 50408 \\ \hline 185992 \\ 176428 \\ \hline 95641 \\ 75612 \\ \hline 200297 \\ 176428 \\ \hline 23869 \\ \hline \hline \end{array}$$

$$(^{20}) 31709$$

Division of Integers.

19

$$^{(20)} 31709 \overline{) 521047321} (16432.$$

$$\begin{array}{r} 31709 \\ \hline 203957 \\ 190254 \\ \hline 137033 \\ 126836 \\ \hline 101972 \\ 95127 \\ \hline 68451 \\ 63418 \\ \hline 5033 \\ \hline \hline \end{array}$$

$$^{(21)} 2701234 \overline{) 7210472532} (2669.$$

$$\begin{array}{r} 5402468 \\ \hline 18080045 \\ 16207404 \\ \hline 18726413 \\ 16207404 \\ \hline 25190092 \\ 24311106 \\ \hline 878986 \\ \hline \hline \end{array}$$

$$^{(22)} 210472 \overline{) 352107193214} (1671990.$$

$$\begin{array}{r} 210472 \\ \hline 1416351 \\ 1262832 \\ \hline 1535199 \\ 1473304 \\ \hline 418953 \\ 210472 \\ \hline 2084812 \\ 1894248 \\ \hline 1905641 \\ 1894248 \\ \hline 113934 \\ \hline \hline \end{array}$$

$$^{(23)} 3721071$$

Division of Integers.

$$\begin{array}{r}
 (23) \quad 3721071 \overline{) 21071921473} (5662 \\
 \underline{18605355} \\
 24665664 \\
 \underline{22326426} \\
 23392387 \\
 \underline{22326426} \\
 10659613 \\
 \underline{7442142} \\
 3217471
 \end{array}$$

CASE III.

$$\begin{array}{r}
 (24) \quad 271 \overline{) 00} 254732 \overline{) 21} (939 \\
 \underline{2439} \\
 1083 \\
 \underline{813} \\
 2702 \\
 \underline{2439} \\
 \text{Rem. } \underline{\underline{26321}}
 \end{array}$$

$$\begin{array}{r}
 (25) \quad 5721 \overline{) 00} 7253472 \overline{) 16} (1267 \\
 \underline{5721} \\
 15324 \\
 \underline{11442} \\
 38827 \\
 3 \quad \underline{4326} \\
 45012 \\
 \underline{40047} \\
 \underline{\underline{496516}}
 \end{array}$$

$$\begin{array}{r}
 (26) \quad 373 \overline{) 000} 752473 \overline{) 719} (2017 \\
 \underline{746} \\
 \dots 647 \\
 \underline{373} \\
 2743 \\
 \underline{2611} \\
 \underline{\underline{132719}}
 \end{array}$$

(27) 215|000)6325104|997(29419.

$$\begin{array}{r}
 430 \\
 \hline
 2025 \\
 1935 \\
 \hline
 .901 \\
 860 \\
 \hline
 410 \\
 215 \\
 \hline
 1954 \\
 1935 \\
 \hline
 19997
 \end{array}$$

CASE IV.

(28) 3)3210473	(29) 7)7210473
9)1070157-2	5)1030067-4
9×3=27. 118906-11	206013-18
7×5=35	
(30) 7)6251043	(31) 9)5761034
6)893006-1	6)640114-8
7×6=42 148834-15	106685-44
9×6=54	

ADDITION OF MONEY, WEIGHTS, AND MEASURES.

MONEY.

£. s. d.	£. s. d.	£. s. d.
(1) 39 6 7 $\frac{1}{4}$	(2) 385 9 1 $\frac{1}{4}$	(3) 388 14 0 $\frac{1}{2}$
(4) 379 9 4 $\frac{1}{2}$	(5) 2752 6 11	(6) 2563 3 10 $\frac{1}{2}$
(7) 315 5 8 $\frac{3}{4}$	(8) 424 11 2	(9) 2042 7 6 $\frac{3}{4}$
(10) 2168 9 3 $\frac{1}{4}$	(11) 306 0 9 $\frac{1}{4}$	(12) 164 0 2 $\frac{1}{2}$

HERE, in the first example, we begin and cast up the column of farthings, and the sum is 9, or two-pence and 1 farthing ;

farthing; set down $\frac{1}{4}$, and carry 2 to the row of pence; the amount of which we find to be 31, or 2 shillings and 7 pence, we set down the 7 pence and carry 2 to the row of shillings, which we add up and find it amounts to 86, or 4 pounds 6 shillings; we set down 6 shillings, and carry 4 pounds, which we add up as in common addition. The whole sum is 39l. 6s. 7 $\frac{1}{4}$. The following examples are also equally easy, due regard being had to the different denominations, and how many of an inferior kind, make one of the next superior.

TROY WEIGHT.

oz. dwt. gr.	oz. dwt. gr.	lb. oz. dwt.
(1) 35 10 2	(2) 43 18 16	(3) 29 9 5
	lb. oz. dwt.	
	(4) 81 0 2	

AVOIRDUPOISE WEIGHT.

lb. oz. dr.	lb. oz. dr.	cwt. qrs. lb.
(1) 184 12 7	(2) 298 10 5	(3) 249 3 26
	ten. cwt. qrs.	
	(4) 35 1 0	

APOTHECARIES WEIGHT.

lb. oz. dr. gr.	lb. oz. dr. gr.	lb. oz. dr. gr.
(1) 3 9 0 13	(2) 37 3 0 3	(3) 51 8 6 2
	lb. oz. dr. gr.	
	(4) 38 7 3 2	

CLOTH MEASURE.

f. e. qr. n.	yds. qr. n.	yds. qr. n.
(1) 307 1 1	(2) 384 1 2	(3) 438 0 0
	e. e. qr. n.	
	(4) 393 1 2	

LONG

LONG MEASURE.

	<i>f.</i>	<i>in.</i>	<i>bar.</i>		<i>yds.</i>	<i>ft.</i>	<i>in.</i>		<i>m.</i>	<i>f.</i>	<i>p.</i>
(¹)	268	0	1	(²)	339	0	0	(³)	361	4	7
					<i>lea.</i>	<i>m.</i>	<i>f.</i>				
				(⁴)	357	0	6				

LAND MEASURE.

	<i>a.</i>	<i>r.</i>	<i>p.</i>		<i>a.</i>	<i>r.</i>	<i>p.</i>		<i>a.</i>	<i>r.</i>	<i>p.</i>
(¹)	272	3	7	(²)	218	0	29	(³)	276	3	17
					<i>a.</i>	<i>r.</i>	<i>p.</i>				
				(⁴)	170	0	3				

WINE MEASURE.

	<i>run.</i>	<i>gal.</i>	<i>qts.</i>		<i>tier.</i>	<i>gal.</i>	<i>qts.</i>		<i>bbds.</i>	<i>gal.</i>	<i>qts.</i>
(¹)	310	4	2	(²)	293	21	3	(³)	404	2	2
					<i>T. bbd.</i>	<i>gal.</i>					
				(⁴)	279	2	22				

ALE and BEER MEASURE.

	<i>a. b.</i>	<i>fir.</i>	<i>gal.</i>		<i>b. b.</i>	<i>fir.</i>	<i>gal.</i>		<i>bbd.</i>	<i>gal.</i>	<i>qts.</i>
(¹)	387	3	2	(²)	351	2	4	(³)	341	50	2
					<i>bbd.</i>	<i>gal.</i>	<i>qts.</i>				
				(⁴)	339	14	3				

DRY MEASURE.

	<i>qrs.</i>	<i>bu.</i>	<i>p.</i>		<i>qrs.</i>	<i>bu.</i>	<i>p.</i>		<i>cb.</i>	<i>bu.</i>	<i>p.</i>
(¹)	395	6	2	(²)	417	3	1	(³)	479	6	1
					<i>cb.</i>	<i>bu.</i>	<i>p.</i>				
				(⁴)	412	3	1				

TIME.

TIME.

	<i>lrs. m. "</i>	<i>da. h. m.</i>	<i>wk. d. b.</i>
(1)	338 58 48	(2) 380 21 5	(3) 373 5 5
		<i>wk. d. b.</i>	
	(4) 380 5 18		

THE APPLICATION TO THE FOREGOING.

$$\begin{array}{r}
 (1) \quad 1750 \\
 \quad 47 \\
 \hline
 \text{Ans.} \quad 1797
 \end{array}$$

	<i>£. s. d.</i>
(2) A laid out	7 15 6
B	2 9 0
C	2 14 6
D	0 7 3
Laid out in all	<u>13 6 3</u>

	<i>£. s. d.</i>
(3) Lent at different times	$ \left\{ \begin{array}{l} 63 \quad 0 \quad 0 \\ 25 \quad 15 \quad 0 \\ 32 \quad 7 \quad 0 \\ 15 \quad 14 \quad 10 \\ 99 \quad 11 \quad 6 \end{array} \right. $
Lent in all	<u>236 8 4</u>

	<i>£. s. d.</i>
(4) 21 guineas	22 1 0
8 score and 19s. 14s.	179 14 0
Ans.	<u>201 15 0</u>

(5) First No.	215
Second do.	519
Third	734
Sum	<u>1468</u>

(6) Paid

Compound Addition.

25

	£.	s.	d.
(6) Paid for goods	54	17	0
packing	0	13	8
carriage	1	5	4
spent	0	14	3
<i>Ans.</i>	57	10	3

(7) Least Number	40
Their difference	14
Greater Number	54
Sum	94

(8) Eleven thousand, &c. is	12111
Add	1500
Eldest sister's fortune	13611
Father left them	25722

	£.	s.	d.
(9) Owed rent	86	2	0
Wine merchant	72	5	0
Confectioner	12	13	4
Draper	47	13	2
Tailor	110	15	6
Coachmaker	157	18	0
Tallowchandler	8	17	9
Cornchandler	170	6	8
Brewer	52	17	0
Butcher	122	11	5
Baker	37	9	5
Wages	53	18	0
To these add	100	0	0
Total	1033	7	3

	yrs.	m.	d.
(10) The father's age when his first child was born	24	0	0
Number of years between each of their births respectively	1	11	14
Fourth's age	2	10	25
The father's age at the time	27	9	12
	58	7	10

Compound Addition.

	£.	s.	d.
(¹¹) Received of A	7	5	2
_____ B	15	18	6 ¹ / ₂
_____ C	150	13	2 ¹ / ₄
_____ D	17	6	8
_____ E	6	9	2
_____ F	0	6	8
_____ G	76	15	9 ¹ / ₂
_____ H	121	12	4
The sum he had to pay	<u>396</u>	<u>7</u>	<u>6¹/₄</u>

	oz.	dwt.
(¹²) Service plate	203	8
Plates	408	9
Spoons	112	8
Salts, &c.	71	7
Knives, &c.	73	5
Cups, &c.	121	4
Tea-kettle, &c.	131	7
Small articles	185	5
	<u>12) 1306</u>	<u>13</u> sum

The whole weight 1086 10 13 dwt.

	Cwt.	qr.	lb.
(¹³)	2	3	13
Weight of the different bags	2	2	11
	2	3	5
	2	3	12
	2	3	15
84 + 84 ÷ 28 &c.	1	2	0
Weight of the whole	<u>15</u>	<u>2</u>	<u>0</u>

	£.	s.	d.
(¹⁴)	103	12	2
	93	3	4
A owes B for goods at different times	121	17	0
	142	15	4
	171	15	10
	142	12	6
	205	7	2
Total	<u>981</u>	<u>3</u>	<u>4</u>

SUBTRACTION OF MONEY, WEIGHTS, AND MEASURES.

MONEY.

(1)	£.	s.	d.	(2)	£.	s.	d.	(3)	£.	s.	d.
	238	18	10 $\frac{3}{4}$		98	1	3 $\frac{3}{4}$		7	19	2 $\frac{3}{4}$
(4)	£.	s.	d.	(5)	£.	s.	d.	(6)	£.	s.	d.
	2	0	6 $\frac{1}{2}$		7	12	8 $\frac{3}{4}$		9	18	2
(7)	£.	s.	d.	(8)	£.	s.	d.	(9)	£.	s.	d.
	64	2	6 $\frac{1}{2}$		22	18	1 $\frac{1}{2}$		51	8	8 $\frac{3}{4}$
(10)	£.	s.	d.	(11)	Paid in all				£.	s.	d.
	387	17	9 $\frac{3}{4}$		Remains to pay				122	18	7 8 $\frac{3}{4}$
									228	89	7 10 $\frac{1}{4}$
(12)	Received in all				£.	s.	d.				
					205	7	14 4 $\frac{3}{4}$				
	Remains due				230	98	7 1 $\frac{1}{4}$				

TROY WEIGHT.

	oz.	dwt.	gr.		oz.	dwt.	gr.		lb.	oz.	dwt.	gr.
(1)	Unfold	6	0	19	(2)	0	18	1	(3)	13	0	11 19
					lb.	oz.	dwt.	gr.				
(4)		1	7	0	22.							

AVOIRDUPOISE WEIGHT.

	lb.	oz.	dr.		lb.	oz.	dr.		cwt.	qr.	lb.
(1)	8	2	2	(2)	5	13	14	(3)	10	0	11
					t.	cwt.	qr.	lb.			
(4)		11	19	3	2						

APOTHECARIES WEIGHT.

	℥	ʒ	ʒ	gr.		℥	ʒ	ʒ	gr.		℔	℥	ʒ	ʒ
(1)	11	6	2	14	(2)	2	1	1	17	(3)	2	8	6	2
						℔	℥	ʒ	ʒ					
(4)		2	11	7	0									

C 2

CLOTH

Compound Subtraction.

CLOTH MEASURE.

(1) *f. e. qrs. n.*
18 0 1(2) *yds. qrs. n.*
11 2 2(3) *yds. qrs. n.*
67 3 1(4) *e. e. qrs. n.*
20 3 3

LONG MEASURE.

(1) *f. in. bar.*
7 10 1(2) *yds. f. in.*
21 2 6(3) *m. f. p.*
26 1 33(4) *lea. m. f. p.*
21 1 3 13

LAND MEASURE.

(1) *a. r. p.*
16 1 0(2) *a. r. p.*
1 3 12(3) *a. r. p.*
7 3 1(4) *a. r. p.*
45 2 36

WINE MEASURE.

(1) *run. gal. qts.*
36 17 3(2) *tier. gal. qts.*
7 33 3(3) *bbds. gal. qts.*
17 61 0(4) *tun. bbd. gal.*
43 2 50

ALE and BEER MEASURE.

(1) *a. b. fir. gal.*
3 3 5(2) *b. b. fir. gal.*
12 0 3(3) *bbds. gal. qts.*
14 30 3(4) *bbds. gal. qts.*
552 0 0

DRY

DRY MEASURE.

qu. bu. p.
(1) 36 7 0

qu. bu. p.
(2) 7 7 2

ch. bu. p.
(3) 24 27 3

ch. bu. p.
(4) 11 30 2

TIME.

hr. m. s.
(1) 22 53 56

da. h. m.
(2) 35 22 24

mo. w. d.
(3) 17 2 3

mo. w. d.
(4) 51 1 0

THE APPLICATION TO THE FOREGOING.

(1) From 1796
Deduct 1723
His age 73

(2) From 1766
Take 1710
Diff. 56

(3) From £. 1156
Deduct 737
A's debt 419

(4) From £. s. 300 0
Sub. 12 score, &c. 254 6
Tax 45 14

(5) From 9154
Take 754 + 305 = 1059
Difference 8095

(6) From £. s. 37 5
Take horse 14 14
Furniture 22 11

Then from £. s. 22 11
Take 14 14
Ans. 7 17

(7) Cash in hand £. s. d. 125 10 7 0
Cleared the first year 452 3 6
Total 12962 10 6
Owed 750 0 0
Neat balance 12212 10 6

C 3

(8) The

Compound Subtraction.

(8)	The whole sum left	£.
	15 thousand 15 hundred, &c.	45247
	Eldest sister's fortune	<u>16530</u>
		<u>28717</u>

(9)	Jan. 3, 1794. A sent in	£.	s.	d.
	— 12, Drew for	152	12	0
		<u>119</u>	<u>12</u>	<u>3</u>
	Difference	32	19	9
	Sent in	<u>171</u>	<u>11</u>	<u>5</u>
	Sum	204	11	2
	— 30, Drew for	21	0	0
	Difference	<u>183</u>	<u>11</u>	<u>2</u>
	— 30, Sent in	<u>31</u>	<u>10</u>	<u>0</u>
	What A had left in	<u>215</u>	<u>1</u>	<u>2</u>

— 3, 1794. What B had in	132	15	2
— 10, Sent in	<u>52</u>	<u>12</u>	<u>6</u>
	Sum	185	7 8
— 12, Drew for	<u>142</u>	<u>14</u>	<u>6</u>
	Difference	42	13 2
— 30, Drew for	<u>21</u>	<u>0</u>	<u>0</u>
	Difference	21	13 2
— 30, Sent in	<u>31</u>	<u>10</u>	<u>0</u>
What B had left in	<u>53</u>	<u>3</u>	<u>2</u>

What C had in at the first	173	8	4
— 6, Added	<u>175</u>	<u>0</u>	<u>0</u>
	Sum	348	8 4
— 12, Drew for	<u>205</u>	<u>10</u>	<u>0</u>
	Difference	142	18 4
— 30, Drew for	<u>21</u>	<u>0</u>	<u>0</u>
	Difference	121	18 4
— 30, Sent in	<u>31</u>	<u>10</u>	<u>0</u>
What C had left in	<u>153</u>	<u>8</u>	<u>4</u>

— 7, 1794, D's whole stock	172	12	6
— 10, Drew for	<u>121</u>	<u>6</u>	<u>2</u>

difference

Compound Subtraction.

31

	Difference	51	6	4
Jan. 25,	Sent in	128	12	4
	Sum	179	18	8
— 21,	Drew for	93	15	2
	Difference	86	3	6
— 30,	Drew for	21	0	0
	Difference	65	3	6
— 30,	Sent in	31	10	0
	What D had left in	96	13	6

	£.	s.	d.		£.	s.	d.
(10) Owed A	53	7	6	Stock	212	6	0
B	105	10	0	Book debts	112	8	3
C	34	5	2	Cash	21	10	5
D	28	16	5	Whole effects	346	4	8
E	14	15	8				
F	112	9	0				
G	143	12	9				
What he owed in all	492	16	6				
Whole effects deduct	346	4	8				
His creditors left	146	11	10				

	£.	s.	d.
(11) Sent Bees-wax to the value of	37	15	4
Stockings	37	6	7
Tobacco	125	11	6
Linen Cloth	112	14	8
Tin	115	10	5
Total value	428	18	6

Wines received in value	250	15	0
Fruit	51	12	6
Figs	19	17	6
Oil	19	12	4
Spanish wool	115	15	6
Total value	457	12	10
Deduct	428	18	6
Due to my Spanish correspondent	28	14	4

MULTIPLI.

MULTIPLICATION OF SEVERAL DENOMINATIONS.

£. s. d.	£. s. d.	£. s. d.
(¹) 71 5 2 $\frac{1}{2}$	(²) 226 19 4 $\frac{1}{2}$	(³) 249 1 5
£. s. d.	lb. oz. dwt. gr.	ton. cwt. qr. lb.
(⁴) 285 11 11 $\frac{3}{4}$	(⁵) 59 5 0 4	(⁶) 203 0 0 8
yds. qr. n.	m. f. p.	a. r. p.
(⁷) 152 3 0	(⁸) 184 3 25	(⁹) 67 2 9
a. b. f. gal.	b. b. f. gal.	m. f. p.
(¹⁰) 227 1 1	(¹¹) 80 0 3	(¹²) 271 2 5

THE PRACTICAL QUESTIONS.

$$\begin{array}{r}
 \text{s. d.} \\
 (1) \quad 9 \quad 6 \\
 \hline
 9 \times 2 = 18 \\
 \hline
 4 \quad 5 \quad 6 \\
 \hline
 2 \\
 \hline
 8 \quad 11 \quad 0 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 (2) \quad 1 \quad 2 \quad 6 \\
 \hline
 8 \times 3 + 2 = 26 \\
 \hline
 9 \quad 0 \quad 0 \\
 \hline
 3 \\
 \hline
 27 \quad 0 \quad 0 \\
 \hline
 2 \quad 5 \quad 0 = \text{top line} \times 2 \\
 \hline
 29 \quad 5 \quad 0 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{s. d.} \\
 (3) \quad 7 \quad 8\frac{1}{2} \\
 \hline
 7 \times 3 = 21 \\
 \hline
 2 \quad 13 \quad 11\frac{1}{2} \\
 \hline
 3 \\
 \hline
 8 \quad 1 \quad 10\frac{1}{2} \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{s. d.} \\
 (4) \quad 15 \quad 3\frac{1}{2} \\
 \hline
 11 \times 3 + 1 = 34 \\
 \hline
 8 \quad 8 \quad 2\frac{1}{2} \\
 \hline
 3 \\
 \hline
 25 \quad 4 \quad 7\frac{1}{2} \\
 \hline
 0 \quad 15 \quad 3\frac{1}{2} \text{ top line add} \\
 \hline
 25 \quad 19 \quad 11 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{s. d.} \\
 (5) \quad 7 \quad 2\frac{3}{4} \\
 \hline
 12 \times 6 + 3 = 75 \\
 \hline
 4 \quad 6 \quad 9 \\
 \hline
 6 \\
 \hline
 26 \quad 0 \quad 6 \\
 \hline
 1 \quad 1 \quad 8\frac{1}{4} \text{ top line} \times 3 \\
 \hline
 27 \quad 2 \quad 2\frac{1}{4} \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{s. d.} \\
 (6) \quad 9 \quad 7 \\
 \hline
 6 \times 6 + 1 = 37 \\
 \hline
 2 \quad 17 \quad 6 \\
 \hline
 6 \\
 \hline
 17 \quad 5 \quad 0 \\
 \hline
 0 \quad 9 \quad 7 \text{ top line add.} \\
 \hline
 17 \quad 14 \quad 7 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

(7) $\begin{array}{r} \text{£. s. d.} \\ 1 \quad 5 \quad 3 \\ 12 \times 8 + 1 = 97 \\ \hline 15 \quad 3 \quad 0 \\ \quad \quad 8 \\ \hline 121 \quad 4 \quad 0 \\ 1 \quad 5 \quad 3 \text{ top line add.} \\ \hline 122 \quad 9 \quad 3 \text{ Ans.} \end{array}$

(8) $\begin{array}{r} \text{s. d.} \\ 6 \quad 4 \\ 6 \times 7 + 1 = 43 \\ \hline 1 \quad 18 \quad 0 \\ \quad \quad 7 \\ \hline 13 \quad 6 \quad 0 \\ 0 \quad 6 \quad 4 \text{ top line add.} \\ \hline 13 \quad 12 \quad 4 \text{ Ans.} \end{array}$

(9) $\begin{array}{r} \text{s. d.} \\ 12 \quad 3 \\ 11 \times 11 + 6 = 127 \\ \hline 6 \quad 14 \quad 9 \\ \quad \quad 11 \\ \hline 74 \quad 2 \quad 3 \\ 3 \quad 13 \quad 6 \text{ top line } \times 6 \\ \hline 77 \quad 15 \quad 9 \text{ Ans.} \end{array}$

(10) $\begin{array}{r} \text{s. d.} \\ 7 \quad 5 \\ 12 \times 11 + 3 = 135 \\ \hline 4 \quad 9 \quad 0 \\ \quad \quad 11 \\ \hline 48 \quad 19 \quad 0 \\ 1 \quad 2 \quad 3 \text{ top line } \times 3 \\ \hline 50 \quad 1 \quad 3 \text{ Ans.} \end{array}$

(11) $\begin{array}{r} \text{s. d.} \\ 1 \quad 4\frac{1}{2} \\ 12 \times 6 + 2 = 74 \\ \hline 16 \quad 6 \\ \quad \quad 6 \\ \hline 4 \quad 19 \quad 0 \\ 0 \quad 2 \quad 9 \text{ top line } \times 2 \\ \hline 5 \quad 1 \quad 9 \text{ Ans.} \end{array}$

(12) $\begin{array}{r} \text{s. d.} \\ 1 \quad 10 \\ 12 \\ \hline 1 \quad 2 \quad 0 \text{ price of 1 dozen} \\ \quad \quad 6 \\ \hline 6 \quad 12 \quad 0 \text{ Ans.} \end{array}$

(13) $\begin{array}{r} \text{s. d.} \\ 3 \quad 4\frac{1}{2} \\ 5 \times 5 + \frac{1}{2} = 25\frac{1}{2} \\ \hline 16 \quad 10\frac{1}{2} \\ \quad \quad 5 \\ \hline 4 \quad 4 \quad 4\frac{1}{2} \\ 0 \quad 1 \quad 8\frac{1}{4} \quad \frac{1}{2} \text{ top line add.} \\ \hline 4 \quad 6 \quad 0\frac{3}{4} \text{ Ans.} \end{array}$

(14) $\begin{array}{r} \text{s. d.} \\ 1 \quad 3 \\ 12 \times 6 + 3\frac{1}{2} = 75\frac{1}{2} \\ \hline 15 \quad 0 \\ \quad \quad 6 \\ \hline 4 \quad 10 \quad 0 \\ 0 \quad 3 \quad 9 \text{ top line } \times 3. \\ 0 \quad 0 \quad 7 \quad \frac{1}{2} \text{ top line add.} \\ \hline 4 \quad 14 \quad 4\frac{1}{2} \text{ Ans.} \end{array}$

$$\begin{array}{r}
 \text{£. s. d.} \\
 0 \quad 4 \quad 3 \\
 \hline
 2 \times 10 = 20 \\
 0 \quad 8 \quad 6 \\
 \hline
 10 \\
 4 \quad 5 \quad 0 \\
 0 \quad 2 \quad 1\frac{1}{2} \quad \frac{1}{2} \text{ top line sub.} \\
 \hline
 4 \quad 2 \quad 10\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 1 \quad 1 \quad 6 \\
 \hline
 7\frac{1}{4} \\
 7 \quad 10 \quad 6 \\
 0 \quad 5 \quad 4\frac{1}{2} \quad \frac{1}{4} \text{ top line add.} \\
 \hline
 7 \quad 15 \quad 10\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 4 \quad 15 \quad 6 \\
 \hline
 7 \times 5 + \frac{1}{2} = 35\frac{1}{2} \\
 33 \quad 8 \quad 6 \\
 \hline
 167 \quad 2 \quad 6 \\
 2 \quad 7 \quad 9 \quad \frac{1}{2} \text{ of top line add} \\
 \hline
 169 \quad 10 \quad 3 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 0 \quad 12 \quad 6 \\
 \hline
 10 \times 11 + 7\frac{1}{4} = 117\frac{1}{4} \\
 6 \quad 5 \quad 0 \\
 \hline
 11 \\
 68 \quad 15 \quad 0 \\
 4 \quad 7 \quad 6 \text{ top line } \times 7 \\
 0 \quad 3 \quad 1\frac{1}{2} \quad \frac{1}{4} \text{ top line add} \\
 \hline
 73 \quad 5 \quad 7\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 0 \quad 1 \quad 4 \\
 \hline
 7 \times 5 + \frac{1}{4} = 35\frac{1}{4} \\
 0 \quad 9 \quad 4 \\
 \hline
 5 \\
 2 \quad 6 \quad 8 \\
 0 \quad 0 \quad 4 \quad \frac{1}{4} \text{ top line add.} \\
 \hline
 2 \quad 7 \quad 0 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 3 \quad 15 \quad 7 \\
 \hline
 6\frac{1}{2} \\
 22 \quad 13 \quad 6 \\
 1 \quad 17 \quad 9\frac{1}{2} \quad \frac{1}{2} \text{ top line add.} \\
 \hline
 24 \quad 11 \quad 3\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 4 \quad 17 \quad 10 \\
 \hline
 12 \times 12 + 10\frac{1}{2} = 154\frac{1}{2} \\
 58 \quad 14 \quad 0 \\
 \hline
 12 \\
 704 \quad 8 \quad 0 \\
 48 \quad 18 \quad 4 \text{ Top line } \times 10 \\
 2 \quad 8 \quad 11\frac{1}{2} \text{ top line add} \\
 \hline
 755 \quad 15 \quad 3 \text{ Sum.}
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 1 \quad 7 \quad 8 \\
 \hline
 8 \times 10 + 5\frac{3}{4} = 85\frac{3}{4} \\
 11 \quad 1 \quad 4 \\
 \hline
 10 \\
 110 \quad 13 \quad 4 \\
 6 \quad 18 \quad 4 \text{ top line } \times 5 \\
 1 \quad 0 \quad 9 \quad \frac{3}{4} \text{ top line add} \\
 \hline
 118 \quad 12 \quad 5 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(23)} \\
 \text{£. s. d.} \\
 1 \quad 3 \quad 6 \\
 10 \times 3 - \frac{3}{4} = 29\frac{1}{4} \\
 \hline
 11 \quad 15 \quad 0 \\
 3 \\
 \hline
 35 \quad 5 \quad 0 \\
 0 \quad 17 \quad 7\frac{1}{2} \quad \frac{3}{4} \text{ top line sub.} \\
 34 \quad 7 \quad 4\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(24)} \\
 \text{£. s. d.} \\
 1 \quad 3 \\
 3 \times 6 - \frac{1}{4} = 17\frac{3}{4} \\
 \hline
 3 \quad 9 \quad 6 \\
 20 \quad 14 \\
 0 \quad 5 \quad 9 \quad \frac{1}{4} \text{ top line sub.} \\
 20 \quad 8 \quad 3 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(25)} \\
 \text{£. s. d.} \\
 0 \quad 12 \quad 4 \\
 6 \times 6 + 1\frac{1}{2} = 37\frac{1}{2} \\
 \hline
 3 \quad 14 \quad 0 \\
 6 \\
 \hline
 22 \quad 4 \quad 0 \\
 0 \quad 12 \quad 4 \text{ top line} \\
 0 \quad 6 \quad 2 \quad \frac{1}{2} \text{ top line add} \\
 23 \quad 2 \quad 6 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(26)} \\
 \text{£. s. d.} \\
 2 \quad 18 \quad 7 \\
 7 \times 8 + \frac{3}{4} = 56\frac{3}{4} \\
 \hline
 20 \quad 10 \quad 1 \\
 8 \\
 \hline
 164 \quad 0 \quad 8 \\
 2 \quad 3 \quad 11\frac{1}{4} \quad \frac{3}{4} \text{ top line add} \\
 166 \quad 4 \quad 7\frac{1}{4} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(27)} \\
 \text{£. s. d.} \\
 2 \quad 15 \quad 6 \\
 12 \times 8 + \frac{1}{2} = 96\frac{1}{2} \\
 \hline
 33 \quad 6 \quad 0 \\
 8 \\
 \hline
 266 \quad 8 \quad 0 \\
 1 \quad 7 \quad 9 \quad \frac{1}{2} \text{ top line add} \\
 267 \quad 15 \quad 9 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(28)} \\
 \text{£. s. d.} \\
 0 \quad 18 \quad 6 \\
 4 \times 11 + 1\frac{3}{4} = 45\frac{3}{4} \\
 \hline
 3 \quad 14 \quad 0 \\
 11 \\
 \hline
 40 \quad 14 \quad 0 \\
 0 \quad 18 \quad 6 \text{ top line} \\
 0 \quad 13 \quad 10\frac{1}{2} \quad \frac{3}{4} \text{ top line add} \\
 42 \quad 6 \quad 4\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(29)} \\
 \text{£. s. d.} \\
 0 \quad 4 \quad 3 \\
 8 \times 11 - \frac{1}{4} = 87\frac{3}{4} \\
 \hline
 1 \quad 14 \quad 0 \\
 11 \\
 \hline
 18 \quad 14 \quad 0 \\
 0 \quad 1 \quad 0\frac{3}{4} \quad \frac{1}{4} \text{ top line sub.} \\
 18 \quad 12 \quad 11\frac{1}{4} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(30)} \\
 \text{£. s. d.} \\
 4 \quad 7 \quad 6 \\
 12 \times 10 + \frac{3}{4} = 120\frac{3}{4} \\
 \hline
 52 \quad 10 \quad 0 \\
 10 \\
 \hline
 525 \quad 0 \quad 0 \\
 3 \quad 5 \quad 7\frac{1}{2} \quad \frac{3}{4} \text{ top line add} \\
 528 \quad 5 \quad 7\frac{1}{2} \text{ Ans.}
 \end{array}$$

THE APPLICATION TO THE FOREGOING.

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 (1) \quad 14 \quad 6 \quad 8\frac{1}{2} \\
 \hline
 6 \times 3 = 18 \\
 \hline
 86 \quad 0 \quad 3 \\
 \hline
 3 \\
 \hline
 258 \quad 0 \quad 9 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 (2) \quad 125 \quad 15 \quad 6 \\
 \hline
 10 \times 12 \times 2 + 10 = 250 \\
 \hline
 1257 \quad 15 \quad 0 \\
 \hline
 12 \\
 \hline
 15093 \quad 0 \quad 0 \\
 \hline
 2 \\
 \hline
 30186 \quad 0 \quad 0 \\
 \hline
 1257 \quad 15 \quad 0 \text{ top line } \times 10 \\
 \hline
 31443 \quad 15 \quad 0 \text{ Ans.}
 \end{array}$$

$$\begin{array}{l}
 (3) \quad 12 \times 6 \times 12 = 864 = \text{six dozen dozen.} \\
 \text{and } 12 \times 6 = 72 = \text{half a dozen dozen.} \\
 \hline
 792 \text{ difference.} \\
 \hline
 936 \text{ sum.} \\
 \hline
 \end{array}$$

then $864 \times 72 = 62208$ the product.

$$\begin{array}{l}
 (4) \quad 58 \times 2 = 116 = \text{twice fifty eight.} \\
 \text{and } 8 \times 2 + 50 = 66 = \text{twice eight and fifty.} \\
 \hline
 850 \text{ diff.} \\
 \hline
 \end{array}$$

then $116 \times 66 = 7656$ their product.

$$\begin{array}{l}
 (5) \quad 45 \times 37 = 1665 \text{ the greater number.} \\
 \text{and } 19 \times 4 = 76 \text{ their difference.} \\
 \hline
 1589 \text{ the least number.} \\
 \hline
 3254 = \text{their sum.}
 \end{array}$$

then $1665 \times 1589 = 2645685$ their product.

$$\begin{array}{l}
 (6) \quad 360 \\
 \hline
 144 \text{ least number.} \\
 \hline
 216 \text{ the greater.} \\
 \hline
 72 \text{ their difference.}
 \end{array}$$

then $216 \times 144 = 31104$ the product, and
 $72 \times 72 = 5184$ the square of their difference.

(7) First

- (7) First $187 \times 157 = 29359$ the number of horse.
 and $207 \times 560 = 115920$ the number of foot.
 145279 men in the whole army.
 473 number of sick sub.
144806 effective soldiers required.

(8) 21 Guineas $\begin{smallmatrix} \text{£.} & \text{s.} \\ = 22 & 1 \end{smallmatrix}$
 $12 \times 7 + 3 = 87$.
 $\begin{array}{r} 264 \ 12 \\ 7 \\ \hline 1852 \ 4 \\ 66 \ 3 \end{array}$ top line $\times 3$.

Half the value of the Petticoat $\begin{array}{r} 1918 \ 7 \\ 2 \\ \hline \end{array}$
 Whole value 3836 \ 14

- (9) First $\begin{smallmatrix} \text{£.} & \text{s.} & \text{d.} \\ 1086 & 0 & 0 \end{smallmatrix} \times 5 = \begin{smallmatrix} \text{£.} & \text{s.} & \text{d.} \\ 5430 & 0 & 0 \end{smallmatrix}$ what he cleared
 the first 5 years.
 and $2715 \ 10 \ 6 \times 4 = 10862 \ 2 \ 0$ what he cleared
 the next 4 years.
 to which add $19118 \ 0 \ 0$ what he began
 trade with.
 $35410 \ 2 \ 0$ his fortune at 9
 year's end.
 Again $475 \ 4 \ 6 \times 3 = 1425 \ 13 \ 6$ lost the last 3
 years in trade.
33984 \ 8 \ 6 his real fortune at
 12 years end.

- (10) First $\begin{smallmatrix} \text{cwt.} & \text{qr.} & \text{lb.} \\ 136 & 2 & 10 \end{smallmatrix} \times 4 = \begin{smallmatrix} \text{cwt.} & \text{qr.} & \text{lb.} \\ 550 & 1 & 12 \end{smallmatrix}$ weight of twelve
 draughts.
 and $13 \ 1 \ 0 \times 12 = 159 \ 0 \ 0$ weight of the tare.
391 \ 1 \ 12 the neat weight of
 coals.

Compound Multiplication.

(¹¹)

£.	s.	d.
1	12	6
$12 \times 10 \times 3 + 5 = 365.$		
19	10	0
<hr/>		
195	0	0
<hr/>		
	3	
585	0	0
1	8	2
top line $\times 5.$		
593	2	6
Add	294	12
	6	
887	15	0
<u>Ans.</u>		

(¹²) In each division were

£.
52
$72 = 12 \times 6.$
<hr/>
The Lady's fortune
3744
<u>Ans.</u>

(¹³) A quarter's rent

£.	s.	d.
8	10	6
Repairs	0	15
	6	
<hr/>		
	7	15
<hr/>		
	4	
Annual cost	31	2
	0	
<hr/>		
	7	
217	14	0
<u>Ans.</u>		

(¹⁴)

	£.	s.	d.		£.	s.	d.
First	37	14		$2 \times 4 =$	150	16	8
then	31	4		$2 \times 4 =$	124	16	8
and	18	12		$6 \times 4 =$	74	10	0
					<hr/>		
What the parishes, &c. paid					350	3	4
					<u>Ans.</u>		

	£.	s.	d.
Then from	386	15	6
take	350	3	4
Deficiency	36	12	2
<u>Ans.</u>			

Compound Division.

39

(15) What the Gentleman left to his Widow	£. s.	4560	0
To his Charity		572	0
To his Nephews	750l. 10s. 0d. × 4 =	3002	0
To his Nieces	375l. 12s. 6d. × 4 =	1502	10
To the Housekeepers	10l. 10s. 0d. × 30 =	315	0
To his Executor		157	10
The sum he possessed at his death		<u>10109</u>	<u>10</u>

(16) The divisor is = 423 + 20 + 19 = 462

Therefore 423

Must be × by 462

846

2538

1692

Rem. add 20

Gives 195446 the dividend required.

DIVISION OF SEVERAL DENOMINATIONS:

(1) £. s. d.	(2) £. s. d.	(3) £. s. d.
12 11 2	12 9 2 1/4	14 6 4 3/4

(4) £. s. d.	lb. oz. dr. gr.	(5) lb. oz. dr.
8 9 4 3/4	12 6 11 4	(6) 5 2 1

(7) t. cwt. qr. lb. oz.	yds. qr. n.	(8) m. f. p.
0 13 3 5 2	3 3 3	(9) 7 5 6 +

(10) yds. f. in. bar.	a. b. fir. gal. qt.
6 2 8 1	(11) 2 3 7 3

D 2

(12) 13

Compound Division.

$$\begin{array}{r} \text{b. b. f. gal. b. b.} \\ (12) \ 13 \overline{) 55 \ 3 \ 7} 4 \end{array}$$

$$\begin{array}{r} \underline{52} \\ 3 \\ \underline{4} \\) 15 (1 \text{ fir.} \\ \underline{13} \\ 2 \\ \underline{9} \\) 25 (1 \text{ gal.} \\ \underline{13} \\ 12 \\ \underline{4} \\) 48 (3 \text{ qts.} \\ \underline{39} \\ 9 \text{ Rem.} \\ \hline \hline \end{array}$$

$$\begin{array}{r} \text{cb. bu. pk. cb.} \\ (13) \ 14 \overline{) 357 \ 2 \ 1} 25 \end{array}$$

$$\begin{array}{r} \underline{28} \\ 77 \\ \underline{70} \\ 7 \\ \underline{32} \\) 226 (16 \text{ bu.} \\ \underline{14} \\ 86 \\ \underline{84} \\ 2 \text{ Rem.} \\ \hline \hline \end{array}$$

THE APPLICATION TO THE FOREGOING.

$$\begin{array}{r} \text{£. s. d.} \\ (1) \ 12 \overline{) 257 \ 2 \ 5} \\ \text{Ans.} \ \underline{\underline{21 \ 8 \ 6\frac{1}{4}}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ (2) \ \left\{ \begin{array}{l} 7 \overline{) 57 \ 3 \ 7} \\ 35 \overline{) 5 \overline{) 8 \ 3 \ 4\frac{1}{4}}} \end{array} \right. \\ \text{Ans.} \ \underline{\underline{1 \ 12 \ 8}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ (3) \ 9 \overline{) 37 \ 6 \ 4\frac{3}{4}} \\ \text{Ans.} \ \underline{\underline{4 \ 2 \ 11}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ (4) \ 20 \left\{ \begin{array}{l} 2 \overline{) 27 \ 5 \ 4\frac{1}{2}} \\ 10 \overline{) 13 \ 12 \ 8\frac{1}{4}}} \end{array} \right. \\ \text{Ans.} \ \underline{\underline{1 \ 7 \ 3}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ (5) \ 120 \left\{ \begin{array}{l} 10 \overline{) 154 \ 17 \ 10} \\ 12 \overline{) 15 \ 9 \ 9\frac{1}{4}}} \end{array} \right. \\ \text{Ans.} \ \underline{\underline{1 \ 5 \ 9\frac{3}{4}}} \end{array}$$

$$\begin{array}{r} \text{£. s. d.} \\ (6) \ 72 \left\{ \begin{array}{l} 6 \overline{) 85 \ 6 \ 0} \\ 12 \overline{) 14 \ 4 \ 4} \end{array} \right. \\ \text{Ans.} \ \underline{\underline{1 \ 3 \ 8\frac{1}{2}}} \end{array}$$

$$\begin{array}{r}
 \text{(7)} \quad 36 \left\{ \begin{array}{l} 6 \overline{) 295 \text{ } 3 \text{ } 5} \\ 6 \overline{) 45 \text{ } 17 \text{ } 2\frac{1}{2}} \\ \quad 7 \text{ } 12 \text{ } 10\frac{1}{4} \\ \quad \quad 2 \\ \hline 15 \text{ } 5 \text{ } 8\frac{1}{2} \text{ Ans.} \end{array} \right.
 \end{array}$$

$$\begin{array}{r}
 \text{(8)} \quad 500 \left\{ \begin{array}{l} 10 \overline{) 7257 \text{ } 3 \text{ } 6} \\ 10 \overline{) 725 \text{ } 14 \text{ } 4} \\ \quad 5 \overline{) 72 \text{ } 11 \text{ } 5} \\ \quad \quad 14 \text{ } 10 \text{ } 3\frac{1}{4} \text{ Ans.} \end{array} \right.
 \end{array}$$

(9) First 509)2545 (5 the No. of bullocks each man must have.

2545

then $\begin{array}{r} \text{£. s. d.} \\ 9 \text{ } 14 \text{ } 6 \end{array}$

10

97 5 0 price of ten bullocks.

10

972 10 0 price of an hundred do.

10

9725 0 0 price of a thousand do.

2

19450 0 0 price of two thousand do.

4862 10 0 price of five hundred do.

389 0 0 price of forty do.

48 12 6 price of five do.

and 509)24750 2 6 (48/ 12s. 6d. each man's share.

$$\begin{array}{r}
 \text{(10)} \quad 35 \left\{ \begin{array}{l} 7 \overline{) 9625} \\ 5 \overline{) 1375} \\ \quad 275 \text{ Ans.} \end{array} \right.
 \end{array}$$

$$\begin{array}{r}
 \text{(11)} \quad 25 \left\{ \begin{array}{l} 5 \overline{) 10 \text{ } 0} \\ 5 \overline{) 2 \text{ } 0} \\ \quad 0 \text{ } 8 \text{ each man's con-} \\ \quad \quad \text{tribution.} \end{array} \right.
 \end{array}$$

$$\begin{array}{r}
 25 \left\{ \begin{array}{l} 5 \overline{) 4000} \\ 5 \overline{) 800} \\ \quad 160 \text{ each man's share.} \end{array} \right.
 \end{array}$$

Compound Division.

(¹²) $\begin{array}{r} \text{£.} \quad \text{£.} \\ 17 \overline{) 1156} \end{array} \begin{array}{l} 68 \text{ Ans.} \\ 102 \\ \hline 136 \\ 136 \\ \hline \end{array}$

(¹³) $\begin{array}{r} \text{£.} \\ 2805 \\ \hline 2 \text{ £.} \\ 7\frac{1}{2} = 15 \overline{) 5610} \end{array} \begin{array}{l} 374 \text{ Ans.} \\ 45 \\ \hline 111 \\ 105 \\ \hline 60 \\ 60 \\ \hline \end{array}$

(¹⁴) First $\begin{array}{r} 43 \\ \hline 129 \\ 129 \\ \hline \end{array}$
 then from 240
 sub. 103
 the No. req. $\begin{array}{r} 137 \\ \hline \end{array}$

(¹⁵) First $\begin{array}{r} 3 \overline{) 20} \end{array} \begin{array}{l} 6 \text{ 8=B's} \\ 4 \text{ 8=A's} \\ 8 \text{ 8=C's} \end{array} \left. \begin{array}{l} \text{is} \\ \text{then} \\ \text{and} \end{array} \right\} \text{Sh.}$
 20 0 proof.

(¹⁶) $1000 - 50 = 950$ then $950 \div 50 = 19$ the Ans.
 (¹⁷) $\begin{array}{r} 7847 \overline{) 3013248} \\ 23541 \\ \hline 65914 \\ 62776 \\ \hline 31388 \\ 31388 \\ \hline \end{array} \begin{array}{l} 384 \text{ Ans.} \end{array}$

(¹⁸) $\begin{array}{r} \text{£.} \\ 28604 \\ \hline 1083 \\ \hline 85812 \\ 228832 \\ \hline 28604 \\ \hline \end{array}$ (¹⁹) $12000 \div 20000 = 12$ each man's share.

(²⁰) First $\begin{array}{r} 8 \overline{) 12} \end{array} \begin{array}{l} 8 \\ 1 \end{array} \begin{array}{l} \text{value of the purse.} \\ 7 \end{array}$
 rem. add. 1788
 dividend $\begin{array}{r} 30979920 \\ \hline \end{array}$
 then $\begin{array}{r} s. \quad d. \quad s. \quad d. \quad s. \quad d. \\ 12 \quad 8 - 1 \quad 7 = 11 \quad 1 \end{array}$ what the purse contained.

NOTE.

NOTE. Before we give a solution to the next question, it will be necessary we apprehend to give the following rule,

RULE.

When the sum and difference of two numbers are given, to the semi-sum of the two numbers, add their semi-difference, and it makes the greater; and from the semi-sum, subtract their semi-difference, and it leaves the less.

	cwt.	gr.	lb.	cwt.	gr.	lb.	oz.	
(²¹) The $\frac{1}{2}$ of	12	3	15	is	6	1	21	8
And $\frac{1}{2}$ of	1	2	13	is	0	3	6	8
					7	1	0	0
								sum = the greater number.
					5	2	15	0
								diff. = the least number.

	£.	s.	d.	£.	s.	d.	
Again, $\frac{1}{2}$ of	14	15	6	is	7	7	9
and $\frac{1}{2}$ of	7	15	0	is	3	17	6
					11	5	3
							sum = the greater price.
					3	10	3
							diff. = the least price.

(²²) First, 3 tons = 60 cwt. therefore 60 cwt. \div 15 = 4 cwt. the weight of each person.

	£.	s.	d.	
(²³) 5	10	0	0	
7	2	0	0	what each ought to have received for attendance if there had been no absentees.
	0	5	$8\frac{1}{2}-\frac{2}{7}$	what each ought to have received a time.

3)	1	2	$10\frac{1}{4}-\frac{1}{7}$	what C and D lost by not attending.
	0	7	$7\frac{1}{4}-\frac{5}{7}$	what A, B, and E, each gained by such non-attendance.

4)	0	5	$8\frac{1}{2}-\frac{2}{7}$	what E lost by his laziness.
	0	1	5	$\frac{4}{7}$ what A, B, C, and D, each gained by E not attending; then, following the conditions of the question, the remaining part of the solution will stand thus,

First,

	£.	s.	d.		£.	s.	d.	
First,	2	4	7	$7\frac{1}{4} \div 7 = 1$	5	7	$= 2$	9 $0\frac{1}{2} - \frac{2}{7} A$
Ditto,					2	9	$0\frac{1}{2} - \frac{2}{7} B$	
then	2	4	1	$5\frac{1}{4} - 11$	5	7	$= 1$	10 $0 - C$
Ditto					1	10	$0 - D$	
and	2	4	7	$7\frac{1}{4} \div 7 = 5$	8	$\frac{1}{2} - \frac{2}{7} = 2$	1	10 $\frac{1}{4} - \frac{3}{7} E$
								<u>10 0 0</u> proof.

NOTE. This question is exceedingly badly expressed, for if we suppose E were absent on one of the days, on which C and D were absent, then would their shares be quite different, as is evident from the very nature of the question.

(24) Here $1000 - 129 + 178 = 693$, and $693 \div 3 = 231 = B's$ share.

then $231 + 129 = 360 = A's$ share.

and $231 + 178 = 409 = C's$ share.

£.	s.	d.	
(25) Here	74	18	2 is what the young fellow owed at first.
	4	14	8 paid off.
2)	33	3	6 remains to pay.
	16	11	9 the half add.
	49	15	3 what his sister owed.
	13	12	10 paid off.
	36	2	5 remains to pay.
	33	3	6 to which add.
	69	5	11 Joseph's debt.
	24	7	3 paid in.
	44	18	8 what he has yet to pay.
	33	3	6 the young man's debt.
	36	2	5 his sister's.
	114	4	7 Total.

then $150 - 114 = 36$ the Ans.

(26) First

(¹⁶) First $12 - 1 \times 2 = 22$ the number of apples the second boy left her.

then $22 - 2 \times 3 \div 2 = 30$ the number the first left her,

and $30 - 10 \times 2 = 40$ the answer required.

BILLS OF PARCELS.

	£.	s.	d.
(¹)	1	16	0
	0	15	10
	2	2	0
	1	5	0
	1	10	0
	0	3	4
<i>Ans.</i>	7	12	2

	£.	s.	d.
(²)	7	2	6
	15	12	0
	11	16	0
	2	10	8
	17	17	6
	7	3	9
<i>Ans.</i>	62	2	5

	£.	s.	d.
(³)	2	10	0
	4	19	0
	4	0	0
	2	14	0
	1	2	2
	1	19	4 $\frac{1}{2}$
<i>Ans.</i>	17	4	6 $\frac{1}{2}$

	£.	s.	d.
(⁴)	11	0	6
	0	10	10
	3	0	0
	2	2	0
	6	6	0
	0	15	0
<i>Ans.</i>	23	14	4

	£.	s.	d.
(⁵)	3	3	9
	8	2	0
	16	10	0
	14	8	0
	2	3	9
	14	17	6
<i>Ans.</i>	59	5	0

	£.	s.	d.
(⁶)	5	1	3
	5	18	9
	3	0	0
	8	12	6
	8	19	11
	7	5	0
<i>Ans.</i>	38	17	5

	£.	s.	d.
(⁷)	0	13	6 $\frac{1}{2}$
	0	14	4 $\frac{1}{2}$
	0	3	6
	0	11	8
	0	6	10 $\frac{1}{2}$
	0	12	10
<i>Ans.</i>	3	2	9 $\frac{1}{2}$

	£.	s.	d.
(⁸)	0	4	0
	0	5	8
	0	12	10
	2	2	4
	0	3	9
	0	11	0
<i>Ans.</i>	3	19	7

	£.	s.	d.
(⁹)	1	14	10
	3	8	3
	2	16	0
	5	12	0
	8	15	0
	1	1	3
<i>Ans.</i>	23	7	4

REDUCTION

REDUCTION DESCENDING.

(1)	£.	(2)	£.	(3)	£.
	8		12		18
	<u>20</u>		<u>20</u>		<u>20</u>
	160 shillings.		240 shillings.		360 shillings.
	<u>12</u>		<u>12</u>		<u>12</u>
	1920 pence.		2880 pence.		4320 pence.
			<u>4</u>		<u>4</u>
			11520 farthings.		17280 farthings

(4)	£. s.	(5)	21 guineas.	(6)	£. s. d.
	7 5				17 5 3 $\frac{1}{4}$
	<u>20</u>		<u>21</u>		<u>20</u>
	145 shillings.		441 shillings.		345 shillings.
	<u>12</u>		<u>12</u>		<u>12</u>
	1740 pence.		5292 pence.		4143 pence.
			<u>4</u>		<u>4</u>
			21168 farthings.		16573 farthings.

(7)	£. s. d.	(8)	cr.	(9)	£.
	25 14 1		15		25
	<u>20</u>		<u>5</u>		<u>4</u>
	514 shillings.		75 shillings.		100 crowns.
	<u>12</u>		<u>2</u>		<u>5</u>
	6169 pence.		150 fixpences.		500 shillings.

(10)	h. cr.	(11)	d.	(12)	£.
	57		52 crowns = 3120		75
	<u>30</u>		52 h. crowns = 1560		<u>18</u>
	1710 pence.		52 shillings = 624		600 h. crowns
	<u>4</u>		and + 52		<u>5</u>
	6840 farthings.		sum 5356 pence.		3000 fixpences
			<u>4</u>		<u>2</u>
			21424 far.		6000 3-pences

REDUCTION ASCENDING.

$\begin{array}{r} d. \\ (13) 12) 1920 \\ 2 0) 16 0 \text{ shillings} \\ \hline 8 \text{ pounds.} \\ \hline \end{array}$	$\begin{array}{r} qrs. \\ (14) 4) 11520 \\ 12) 2880 \text{ pence.} \\ 2 0) 24 0 \text{ shillings.} \\ \hline 12 \text{ pounds.} \\ \hline \end{array}$	$\begin{array}{r} qrs. \\ (15) 4) 17280 \\ 12) 4320 \text{ pence.} \\ 2 0) 36 0 \text{ shill.} \\ \hline 18 \text{ pounds.} \\ \hline \end{array}$
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$\begin{array}{r} d. \\ (16) 12) 1740 \\ 2 0) 14 5 \text{ shillings.} \\ \hline \pounds. 7 \text{ } 5 \text{ } 0 \\ \hline \end{array}$	$\begin{array}{r} qrs. \\ (17) 4) 21168 \\ 12) 5292 \\ 3) 441 \\ 7) 147 \\ \hline 21 \text{ guineas.} \\ \hline \end{array}$	$\begin{array}{r} qrs. \\ (18) 4) 16573 \\ 12) 4143 \frac{1}{4} \\ 2 0) 34 5 \text{ } 3 \\ \hline \text{Ans. } \pounds. 17 \text{ } 5 \text{ } 3 \frac{1}{4} \\ \hline \end{array}$
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$\begin{array}{r} d. \\ (19) 12) 6169 \\ 2 0) 51 4 \text{ } 1 \\ \hline \pounds. 25 \text{ } 14 \text{ } 1 \text{ } \text{Ans.} \\ \hline \end{array}$	$\begin{array}{r} d. \\ (20) 12) 900 \\ 5) 75 \text{ shillings.} \\ \hline 15 \text{ crowns.} \\ \hline \end{array}$	$\begin{array}{r} d. \\ (21) 5) 500 \\ 4) 100 \text{ crowns.} \\ \hline 25 \text{ pounds.} \\ \hline \end{array}$
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$\begin{array}{r} qrs. \\ (22) 4) 6840 \\ 3 0) 171 0 \text{ pence.} \\ \hline 57 \text{ h. crowns.} \\ \hline \end{array}$	$\begin{array}{l} d. \quad d. \quad d. \quad d. \quad d. \\ (23) 60 + 30 + 12 + 1 = 103 = 412 \text{ qrs.} \\ \text{hence } 21424 \text{ qrs. } \div 412 = 52, \text{ the} \\ \text{number of each required.} \end{array}$
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$$\begin{array}{r} (24) 2) 6000 \text{ threepences.} \\ 5) 3000 \text{ sixpences.} \\ 8) 600 \text{ h. crowns.} \\ \hline 75 \text{ pounds.} \\ \hline \end{array}$$

ASCENDING AND DESCENDING.

$\begin{array}{r} d. \\ (25) 6 0) 156 0 \\ 26 \text{ crowns.} \\ \hline 5 \\ 130 \text{ shillings.} \\ \hline \end{array}$	$\begin{array}{r} s. \\ (26) 5(130 \\ 26 \text{ crowns.} \\ \hline 60 \\ 1560 \text{ pence.} \\ \hline \end{array}$	$\begin{array}{r} \text{gui.} \\ (27) 60 \\ 21 \\ 5) 1260 \text{ shillings.} \\ 4) 252 \text{ crowns.} \\ \hline 63 \text{ pounds.} \\ \hline \end{array}$
--	---	--

Reduction.

$$\begin{array}{r} \text{£.} \\ (28) \quad 63 \\ \underline{4} \end{array}$$

252 crowns.

$$\begin{array}{r} \text{£.} \\ 21 \left\{ \begin{array}{l} 3) 1260 \text{ shillings.} \\ 7) 420 \\ \underline{60} \text{ guineas.} \end{array} \right. \end{array}$$

$$(29) \quad 76$$

27

210 205 12 shillings.

$$\text{£. } 102 \text{ } 12 \text{ s.}$$

$$\begin{array}{r} \text{£.} \quad \text{s.} \\ (30) \quad 102 \quad 12 \\ \underline{20} \end{array}$$

$$27 \left\{ \begin{array}{l} 3) 2052 \text{ shillings.} \\ 9) 684 \\ \underline{76} \text{ moidores.} \end{array} \right.$$

$$(31) \quad 60 + 30 + 12 = 102 \text{ the divisor,}$$

and 5567 = 133440d. the
dividend, then $133440 \div 102$
= 1308 of each, and 2s. over.

$$\begin{array}{r} \text{s.} \\ (32) \quad 1308 \text{ half crowns} = 3270 \\ 1308 \text{ crowns} = 6540 \\ \text{to which add} \quad 1308 \\ \text{sum } 210) 111118 \end{array}$$

$$\text{£. } 555 \text{ } 18 \text{ } 21) 2170 (103 \text{ guineas.}$$

21

70

63

7 over.

=

$$\begin{array}{r} \text{gui.} \quad \text{s.} \\ (34) \quad 103 \quad 7 \\ \underline{21} \end{array}$$

$$210) 2170$$

$$7) 108 \text{ } 10$$

$$\text{£. } 15 \text{ } 10 \text{ each}$$

$$\begin{array}{r} \text{£.} \quad \text{s.} \\ (35) \quad 12 \text{ guineas} = 12 \text{ } 12 \\ \text{a crown} = 0 \text{ } 5 \\ \text{a moidore} = 1 \text{ } 7 \\ \text{in each purse } 14 \text{ } 4 \end{array}$$

$$5 \times 5 = 25$$

$$71 \text{ } 0$$

5

$$\text{Ans. } 355 \text{ } 0$$

(36) First 3) $\begin{array}{r} \text{£. s. d.} \\ 50 \quad 0 \quad 0 \end{array}$ $d.$
 $\begin{array}{r} 16 \quad 13 \quad 4 \\ \hline \end{array} = 4000$; the $\frac{1}{80}$ of which is 66,
 number of men, with a remainder
 of 3s. 4d.

then 4) $\begin{array}{r} 50 \quad 0 \quad 0 \end{array}$ $d.$
 $\begin{array}{r} 12 \quad 10 \quad 0 \\ \hline \end{array} = 3000$; the $\frac{1}{30}$ of which is 100, num-
 ber of women,

and 5) $\begin{array}{r} 50 \\ \hline \end{array}$
 $10 = 200s. =$ the number of boys,

also 6) $\begin{array}{r} 50 \quad 0 \quad 0 \end{array}$ $d.$
 $\begin{array}{r} 8 \quad 6 \quad 8 \\ \hline \end{array} = 2000$; the $\frac{1}{9}$ of which is 222, num-
 ber of girls, with a remainder
 of 2d.

$\begin{array}{r} \text{£. s. d.} \\ 6 \quad 13 \quad 4 \end{array}$ and $\begin{array}{r} \text{£.} \quad \text{£. s.} \\ 50 - 47 \quad 10 = 2 \quad 10 \end{array}$, hence
 then being added $\begin{array}{r} 12 \quad 10 \quad 0 \\ \hline \end{array}$ $2l. 10s. + 3s. 6d. = 2l. 13s. 6d.$
 gives the $\begin{array}{r} 10 \quad 0 \quad 0 \\ \hline \end{array}$ what the distributor is to have
 $\begin{array}{r} 8 \quad 6 \quad 8 \\ \hline \end{array}$ for his pains.

total bequeathed $\begin{array}{r} 47 \quad 10 \quad 0 \\ \hline \hline \end{array}$

TROY WEIGHT.

(37) $\begin{array}{r} \text{oz.} \\ 27 \\ 20 \\ \hline 540 \\ 24 \\ \hline 12960 \text{ grs.} \end{array}$

(38) $\begin{array}{r} \text{grs.} \\ 24 \left\{ \begin{array}{l} 4 \mid 12960 \\ 6 \mid 3240 \\ 2 \mid 0 \mid 510 \\ \hline 27 \text{ oz.} \end{array} \right. \\ \hline \end{array}$

(39) $\begin{array}{r} \text{lb. oz. dw. gr.} \\ 3 \quad 10 \quad 7 \quad 5 \\ 12 \\ \hline 46 \\ 20 \\ \hline 927 \\ 24 \\ \hline 22253 \text{ grs.} \end{array}$

Reduction.

lb. oz. dwt. gr.
(40) 7 4 17 15
8

59 3 1 0 8 ingots. 88

12
711 oz.

20
14221 dwt.

24
341304 gr.

lb. oz. dwt. gr.

(42) 23 5 7
7

164 1 9 7 ingots.

12

1969

20

39389

24

945336 gr.

lb. oz. dwt. gr.
(41) 7 4 17 15

12

20

1777

24 gr.

42663)341304(8 Ans.

341304

oz. dwt. dwt.

(43) First 2 16=56 the weight of
a spoon.
and 50=8=1008 the weight
of the tankard.
then 56(1008(18 the number
he must have.

oz. dwt. gr.

(44) First weight of a tankard=17 15 10

spoon =21 11 13

salt =3 10 0

fork =21 11 13

sum 64 8 8

gr.

=30920 the divisor.

oz. dwt. gr. gr.

And 137 6 9=65913 the dividend, therefore

30920)65913(2 of each sort.

61840 oz. dwt. gr.

rem. 4073=8 9 17 over.

AVOIR.

AVOIRDUPOISE WEIGHT.

$$\begin{array}{r}
 (45) \ 16 \left\{ \begin{array}{l} 4 \overline{) 14769} \\ 4 \overline{) 3692} \end{array} \right. \text{ 1 oz.} \\
 112) 923 \text{ (8 cwt.} \\
 \underline{896} \\
 27 \text{ lb.} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb. oz.} \\
 (45) \ 8 \ 0 \ 27 \\
 \underline{4} \\
 32 \text{ qr.} \\
 \underline{28} \\
 923 \text{ lb.} \\
 \underline{16} \\
 14769 \text{ oz.} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (47) \ 2 \ 1 \ 14 \\
 \underline{4} \\
 9 \\
 28 \\
 \underline{266} \text{ weight of one bag.} \\
 32 \\
 8512 \text{ weight of 32 bags.} \\
 150 \text{ add.}
 \end{array}$$

$$\begin{array}{r}
 \text{ton. cwt. qr. lb.} \\
 (48) \ 34 \ 17 \ 1 \ 19 \\
 \underline{20} \\
 697 \\
 \underline{4} \\
 2789 \\
 \underline{28} \\
 78111 \text{ lb.} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 112) 8662 \text{ (77 cwt.} \\
 \underline{784} \\
 822 \\
 \underline{784} \\
 38 = 1 \text{ qr. 10 lb.} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \quad \text{lb.} \quad \text{cwt.} \\
 (49) \ 350 \times 3 \div 2 = 525 \text{ Ans.} \quad (50) \ 27 \\
 \underline{4} \\
 108 \\
 28
 \end{array}$$

$$18) 3024 \text{ (168 the Ans.}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (51) \ 9 \ 2 \ 14 \\
 \underline{4} \\
 38 \\
 28 \\
 \underline{1078} \text{ lb.} \\
 \underline{\quad}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \quad \text{lb.} \\
 (52) \ 547 \times 3 \div 2 = 820\frac{1}{2} \text{ the Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (33) \quad 2 \quad 1 \quad 15 \\
 \hline
 \quad \quad \quad 3 \times 9 = 27. \\
 \quad \quad \quad 7 \quad 0 \quad 17 \\
 \quad \quad \quad \quad 9 \\
 \hline
 \quad 64 \quad 1 \quad 13 = 27 \text{ bags.} \\
 137 \text{ lb.} = 1 \quad 0 \quad 25 = \text{one bag.} \\
 \hline
 \underline{\underline{65 \quad 2 \quad 10 \text{ the Ans.}}}
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr.} \\
 (34) \quad 8 \quad 3 \\
 \hline
 \quad \quad \quad 3 \times 9 = 27. \\
 \quad \quad \quad 26 \quad 1 \\
 \quad \quad \quad \quad 9 \\
 \hline
 \quad 236 \quad 1 \\
 \quad \quad \quad 4 \\
 \hline
 \quad 945 \\
 \quad \quad \quad 28 \\
 \hline
 \underline{\underline{26460 \text{ lb.}}}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \qquad \qquad \text{lb.} \\
 (35) \quad 552 \times 2 \div 3 = 368 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{lb. oz.} \\
 (36) \quad 16 \quad 2 \\
 \quad \quad 16 \\
 \hline
 \underline{\underline{258 \text{ divisor.}}}
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 \text{and } 16 \quad 1 \quad 15 \\
 \quad \quad 4 \\
 \quad \quad 65 \\
 \quad \quad 28 \\
 \hline
 \quad 1835 \\
 \quad \quad 16 \\
 \hline
 258) 29360 (113 \text{ parcels.} \\
 \quad \underline{258} \\
 \quad \quad 356 \\
 \quad \quad \underline{258} \\
 \quad \quad \quad 980 \\
 \quad \quad \quad \underline{774} \\
 \quad 16) 206 (12 \text{ lb.} \\
 \quad \quad \underline{192} \\
 \quad \quad \quad 14 \text{ oz.} \\
 \quad \quad \quad \underline{\quad}
 \end{array}$$

TARE

TARE AND TRET.

<i>cwt. qr. lb.</i>	<i>qr. lb.</i>
(⁵⁷) 5 2 5	(⁵⁸) 3 19
7	28
<u>38 3 7 = gross.</u>	103
23 × 7 = 161 lb. = 1 1 21 = tare.	<u>241</u>
<u>37 1 14 = neat.</u>	248 23 = gross.
	241 × 10 = 2410 = tare.
	<u>22413 = neat.</u>

<i>bhds.</i>	<i>cwt. qr. lb.</i>
(⁵⁹) 25	163 2 15 gross.
100 cwt.	22 1 8 tare.
112) 2500 (22	<u>141 0 7 neat.</u>
224	
260	
224 qr.	

28) 36 (1
28
8 lb.

lb. oz.
(⁶⁰) 3 5
4 × 4 = 16.
13 4
4
53 0 tare

lb. oz.
85 4
4 × 4 = 16.
341 0
4
1364 0 gross.
53 0 tare.
1311 0 neat.

cwt. qr. lb.
(⁶¹) 75 1 14 gross.
752 lb. = 6 2 24 tare.
68 2 18 neat.

cwt. qr. lb.
(⁶²) 0 2 27
6 × 12 + 3 = 75.
4 1 22
12
53 1 12
2 0 25 top line × 3.
55 2 9 gross.
597 lb. = 5 1 9 tare.
50 1 0 neat.

E 3

(63) 8

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (63) \quad 8 \quad 2 \quad 5 \\
 \quad \quad \quad 9 \times 2 = 18. \\
 \hline
 76 \quad 3 \quad 17 \\
 \quad \quad \quad 2 \\
 \hline
 14 = \frac{1}{8}) 153 \quad 3 \quad 6 \text{ grofs.} \\
 \quad \quad 19 \quad 0 \quad 25\frac{1}{4} \text{ tare.} \\
 \hline
 134 \quad 2 \quad 8\frac{3}{4} \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr.} \\
 (64) \quad 2 \quad 1 \\
 \quad \quad \quad 5 \times 5 = 25. \\
 \hline
 11 \quad 1 \\
 \quad \quad \quad 5 \\
 \hline
 16 = \frac{1}{7}) 56 \quad 1 \text{ grofs.} \\
 \quad \quad \quad 8 \quad 0 \quad 4 \text{ lb. tare.} \\
 \hline
 48 \quad 0 \quad 24 \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (65) \quad 8 \quad 3 \quad 14 \\
 \quad \quad \quad 9 \\
 \hline
 16 = \frac{1}{7}) 79 \quad 3 \quad 14 \text{ grofs.} \\
 \quad \quad 11 \quad 1 \quad 18 \text{ tare.} \\
 \hline
 68 \quad 1 \quad 24 \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (66) \quad 14 = \frac{1}{8}) 84 \quad 2 \quad 14 \text{ grofs.} \\
 \quad \quad \quad 10 \quad 2 \quad 8\frac{3}{4} \text{ tare.} \\
 \hline
 74 \quad 0 \quad 5\frac{1}{4} \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (67) \quad 12 \quad 2 \quad 24 \\
 \quad \quad \quad 4 \\
 \hline
 50 \\
 28 \\
 \hline
 14 = \frac{1}{8}) 1424 \text{ grofs.} \\
 \quad \quad 178 \text{ tare.} \\
 \hline
 26) 1246 \text{ futtle.} \\
 \quad \quad 47 \text{ tret.} \\
 \hline
 1199 \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (68) \quad 7 \quad 3 \quad 27 \text{ grofs.} \\
 \quad \quad \quad 0 \quad 1 \quad 8 \text{ tare.} \\
 \hline
 7 \quad 2 \quad 19 \text{ futtle.} \\
 \quad \quad \quad 4 \\
 \hline
 30 \\
 28 \\
 \hline
 26) 859 \\
 \quad \quad 33 \text{ tret} \\
 \hline
 826 \text{ lb. neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (69) \quad 8 = \frac{1}{14}) 152 \quad 1 \quad 3 \text{ grofs.} \\
 \quad \quad 2 = \frac{1}{4}) 10 \quad 3 \quad 14 \text{ } \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{tare.} \\
 \quad \quad \quad 2 \quad 2 \quad 24 \\
 \hline
 26) 138 \quad 2 \quad 21 \text{ futtle.} \\
 \quad \quad \quad 5 \quad 1 \quad 9 \text{ tret.} \\
 \hline
 133 \quad 1 \quad 12 \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{cwt. qr. lb.} \\
 (70) \quad 117 \quad 0 \quad 21 \text{ grofs.} \\
 \quad \quad \quad 1 \quad 2 \quad 5 \text{ tare.} \\
 \hline
 26) 115 \quad 2 \quad 16 \text{ futtle.} \\
 \quad \quad \quad 4 \quad 1 \quad 22 \text{ tret.} \\
 \hline
 111 \quad 0 \quad 22 \text{ neat.} \\
 \hline
 \hline
 \end{array}$$

Reduction.

55

cwt. qr. lb.		cwt. qr. lb.
(71) $7 = \frac{1}{8}$	15 3 20 gross 0 3 27½ tare	(72) 5 2 7 7
26) 14 3 20½ ta. fut.	8 = $\frac{1}{4}$ 38 3 21 gross 0 2 8 tret 2 3 3½ tare	
14 1 12½ tret fut.	26) 36 0 17½ tare futle 9½ cloff 1 1 15½ tret	
14 1 3 neat	34 3 2 tret futle 22 cloff	
	34 2 8 neat	

APOTHECARIES WEIGHT.

lb	oz	dr	gr.		grs.
(73) 27	7	2	1	2	(74) 2 0) 15902 2
12					3) 7951
33½					8) 2650
8					12) 331
2650					lb 27-7
3					
7951					
20					
159022					
grains					

CLOTH MEASURE.

yds.		e.c.		yds. qr.
(75) 27		(76) 75		(77) 93 3
4		5		4
108		4) 375		5) 375
4				75 Ans.
432 nails		yds. 93 3	qr.	

(78) 24

$$\begin{array}{r}
 \text{pie.} \\
 (78) \quad 24 \\
 \quad 32 \\
 \hline
 \quad 768 \\
 \quad 3 \\
 \hline
 5) 2304 \\
 \hline
 \text{Ells} \quad 460 \quad 4 \text{ qr.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{f.e.} \\
 (79) \quad 27 \\
 \quad 17 \\
 \hline
 \quad 189 \\
 \quad 27 \\
 \hline
 \quad 459 \\
 \quad 3 \\
 \hline
 4) 1377 \\
 \hline
 \text{yds.} \quad 344 \quad 1 \text{ qr.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{ells.} \\
 (80) \quad 27 \\
 \quad 27 \\
 \hline
 \quad 729 \\
 \quad 5 \\
 \hline
 4) 3645 \\
 \hline
 \text{yds.} \quad 911 \quad 1 \text{ qr.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{yds. qr.} \\
 (81) \quad 911 \quad 1 \\
 \quad 4 \\
 \hline
 5) 3645 \\
 \hline
 \quad 729 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{pie.} \\
 (82) \quad 25 \\
 \quad 12 \\
 \hline
 \quad 300 \\
 \quad 15 \\
 \hline
 \quad 4500 \\
 \quad 5 \\
 \hline
 4) 22500 \\
 \hline
 \quad 5625 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

LONG MEASURE.

$$\begin{array}{r}
 \text{m.} \\
 (83) \quad 57 \\
 \quad 8 \\
 \hline
 \quad 456 \text{ fur.} \\
 \quad 40 \\
 \hline
 18240 \text{ poles} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 (84) \quad 5280 \text{ ft. in a mile} \\
 \quad 7 \\
 \hline
 \quad 36960 \text{ feet} \\
 \quad 12 \\
 \hline
 \quad 443520 \text{ inches} \\
 \quad 3 \\
 \hline
 1330560 \text{ barley-corns} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{poles.} \\
 (85) \quad 410) 18240 \\
 \quad 8) 456 \text{ furlongs} \\
 \quad 57 \text{ miles} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{yds.} \\
 (86) \quad 1760 \\
 \quad 3 \\
 \hline
 \quad 5280 \text{ yards in a league} \\
 \quad 72 \\
 \hline
 \quad 10560 \\
 \quad 36960 \\
 \hline
 380160 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{yds. m.} \\
 (87) \quad 1760) 380160 (216 = 72 \text{ leagues.} \\
 \quad 3520 \\
 \hline
 \quad 2816 \\
 \hline
 \quad 1760 \\
 \hline
 \quad 10560 \\
 \hline
 \quad 10560 \\
 \hline
 \hline
 \end{array}$$

	<i>a.</i>	<i>r.</i>	<i>p.</i>	
(93)	5	0	0	first
	4	0	2	second
	7	3	0	third
	2	1	0	fourth
	<hr/>			
	19	0	2	sum

} field contains.

$$\begin{array}{r} 4 \\ \hline 76 \\ \hline 40 \end{array}$$

3042 per. then $3042 \div 75 = 40$ shares, and 42 perches.

WINE MEASURE.

(94) 252 gallons in a ton

$$\begin{array}{r} 5 \\ \hline 1260 \text{ gallons in 5 do.} \\ 8 \\ \hline 10080 \text{ pints.} \end{array}$$

(95) $\begin{array}{r} \text{pts.} \\ 8 \overline{) 10080} \\ 252 \overline{) 1260} (5 \text{ tons} \\ \underline{1260} \end{array}$

(96) First, A pipe and a hoghead are $= 126 + 63 = 189$ gallons, the divisor, whence $5896 \div 189 = 31$ of each, and 37 gallons over.

(97) 504 qts. in a pipe

$$\begin{array}{r} 2 \\ \hline 3 \overline{) 1008} \\ 12 \overline{) 336} \text{ qts.} \\ \hline 28 \text{ doz. qt. bottles} \end{array}$$

then from $\begin{array}{r} \text{qts.} \\ 540 \\ \text{take } 336 \\ \hline \text{diff. } 168 \end{array}$

$$\begin{array}{r} 2 \\ \hline 12 \overline{) 336} \text{ pints} \\ \hline 28 \text{ doz. pint bottles} \end{array}$$

ALE

ALE AND BEER MEASURE.

<i>bar.</i>	<i>bar.</i>	<i>hhds.</i>	<i>bar.</i>
(⁹⁸) 46	(⁹⁹) 10	(¹⁰⁰) 72	(¹⁰¹) 108
36	32	3	2
<u>1656 gal.</u>	<u>320 gal.</u>	<u>2)216</u>	<u>3)216</u>
8	4 gal.	108 bar.	72 hhds.
<u>13248 pints</u>	<u>1280 qts.</u>		

DRY MEASURE.

<i>qu.</i>	
(¹⁰²) 120	(¹⁰³) First $64 \times 4 = 256$ qts. in a quarter,
8	then $256)30720$ (120 quarters.
<u>960 bushels</u>	
4	
<u>3840 pecks</u>	
2	
<u>7680 gallons</u>	
4	
<u>30720 quarts</u>	

<i>ch.</i>	<i>lasts.</i>
(¹⁰⁴) 20	(¹⁰⁵) 273
36 bush. in a chaldron	320 pecks in a last
<u>720</u>	<u>87360 pecks</u>
4	
<u>2880 pecks</u>	

TIME.

<i>ho. wks.</i>	<i>yrs.</i>
(¹⁰⁶) 168)72015(428	(¹⁰⁷) 1794
672	$365\frac{1}{4}$ days in a year.
<u>481</u>	<u>8970</u>
336	10764
<u>1455</u>	5382
1344	$448\frac{1}{2} = \frac{1}{4}$ of the top line.
24)111(4 days.	<u>655258$\frac{1}{2}$ days.</u>
96	
<u>15 hours.</u>	

Single Rule of Three Direct.

(¹⁰⁸) First $1108 + 1794 = 2902$ years since,
which multiplied by 8766 hours in a year,

$$\begin{array}{r}
 17412 \\
 17412 \\
 20314 \\
 23216 \\
 \hline
 \text{gives } 25438932 \text{ hours, the } \textit{Ans}.
 \end{array}$$

(¹⁰⁹) From November 17 to the first of January following are 44 days, and from the first of January to the first of September are found, by inspecting the table at the end of our author, to be 243 days, whence $44 + 243 + 12 = 299$ days, the answer.

(¹¹⁰) From the first of July to the first of December, by the before-mentioned table, are 153 days, whence $153 + 27 - 18 = 162$ days the answer.

(¹¹¹) First $1750 - 1723 = 27$, the time betwixt July 18, 1723, and July 18, 1750; but betwixt April 18 and July 18, are 91 days, therefore the time is 26 years and $27\frac{1}{4}$ days; again

$$\begin{array}{r}
 365\frac{1}{4} = \text{days in a year.} \\
 \text{which multiplied by } 26 \\
 \text{gives } 9496\frac{2}{4} \\
 \text{to which add } 274\frac{1}{4} \\
 \text{and the sum } 9770\frac{3}{4} \text{ is the number of days required,}
 \end{array}$$

THE SINGLE RULE OF THREE DIRECT.

$$\begin{array}{r}
 \text{lb. d. lb.} \\
 (1) \text{ As } 1 : 4\frac{1}{2} :: 54 \\
 \hline
 4\frac{1}{2} \\
 216
 \end{array}$$

$$\begin{array}{r}
 \frac{1}{2} \text{ top line } 27 \\
 12) 243
 \end{array}$$

$$\begin{array}{r}
 20s. 3d. \textit{Ans}.
 \end{array}$$

$$\begin{array}{r}
 \text{gal. d. gal.} \\
 (2) \text{ As } 1 : 3 :: 32 \\
 \hline
 3 \\
 12) 96 \\
 8s. \textit{Ans}.
 \end{array}$$

(1) Stated thus, if $1 p. : 4\frac{1}{2} s. :: 144 p. = 12 doz.$ then $144 \times 4\frac{1}{2} = 648s.$ which divided by 20, will give $32l. 8s.$ the answer.

(2) Stated thus, if $12 doz. = 144 p. : 32l. 8s. :: 1 p.$ then $32l. 8s. \times 20 = 648s.$ which divided by 144, will give $4s. 6d.$ the answer.

(3) Stated thus, if $1 yd. : 15\frac{1}{2} s. :: 32 yd.$ then $32 \times 15\frac{1}{2} = 496s.$ which divided by 20, will give $24l. 16s.$ the answer.

(4) Stated thus, if $32 yds. : 24l. 16s. :: 1 yd.$ then $24l. 16s. \times 20 = 496s.$ which divided by 32, will give $15s. 6d.$ the answer.

(5) Stated thus, if $1 lb. : 10\frac{1}{2} d. :: 112 lb.$ then $112 \times 10\frac{1}{2} = 1176d.$ which divided by 12 and 20, will give $4l. 18s.$ the answer.

(6) Stated thus, if $112 lb. : 4l. 18s. :: 1 lb.$ then $4l. 18s. \times 20$ and $12 = 1176d.$ which divided by 112, will give $10\frac{1}{2}d.$ the answer.

(7) Stated thus, if $1 ell. : 12\frac{1}{2} s. :: 400 ell. = 20 \times 20$, then $400 \times 12\frac{1}{2} = 5000s.$ which divided by 20, will give 250l. the answer.

(8) Stated thus, if $400 ell. : 250l. :: 1 ell.$ then $250 \times 20 = 5000s.$ which divided by 400, will give $12s. 6d.$ the answer.

(9) First $25 cwt. 3 qr. 14 lb. = 2898 lb.$ —Stated thus, if $1 lb. : 15\frac{1}{2} d. :: 2898 lb.$ then $2898 \times 15\frac{1}{2} = 44919d.$ which divided by 12 and 20, will give $187l. 3s. 3d.$ the answer.

(10) Stated thus, if $2898 lb. : 187l. 3s. 3d. :: 1 lb.$ then $187l. 3s. 3d. = 1s. 3\frac{1}{2}d.$ the answer.

(11) Stated thus, if $1 yd. : 6s. 9\frac{1}{2}d. :: 27\frac{3}{4} yds.$ then $6s. 9\frac{1}{2}d. \times 27\frac{3}{4} = 9l. 5s. 0d. \frac{3}{4} - 2$ the answer.

(12) First $17 cwt. 1 qr. 14 lb. = 1946 lb.$ —Stated thus, if $1 lb. : 3\frac{1}{4}d. :: 1946 lb.$ then $1946 \times 3\frac{1}{4} = 6322\frac{1}{2}d.$ which divided by 12 and 20, will give $26l. 7s. 0\frac{1}{2}d.$ the answer.

(13) Stated thus, if $1 oz. : 5\frac{1}{2}d. :: 3582 oz. = 2 cwt.$ then $3584 \times 5\frac{1}{2} = 19712d.$ which divided by 12 and 20, will give $82l. 2s. 8d.$ the answer.

(14) First $2l. 14s. 3d. = 2604 qrs.$ and $21l. 11s. 1\frac{1}{2}d. = 20694 qrs.$ then state it thus, if $2604 qrs. : 3\frac{1}{2}d. :: 20694 qrs.$ then $20694 \times 3\frac{1}{2} = 72429$, which divided by 2604 will give $27 yds. 3 qrs. 1 n. 84 rem.$ the answer.

(¹⁷) Stated thus, if $3\frac{1}{2} \text{ lb.} = 7 \text{ b. lb.} : 13 \text{ d.} :: 224 \text{ b. lb.} = (112 \text{ lb.})$ then $224 \times 13 = 2912 \text{ d.}$ which divided by 7, 12, and 20, will give $1 \text{ l. } 14 \text{ s. } 8 \text{ d.}$ the answer.

(¹⁸) Stated thus, if $112 \text{ lb.} : 416 \text{ d.} = (1 \text{ l. } 14 \text{ s. } 8 \text{ d.}) :: 3\frac{1}{2} \text{ lb.}$ then $416 \times 3\frac{1}{2} = 1456 \text{ d.}$ which divided by 112, will give 13 d. the answer.

(¹⁹) First $1 \text{ cwt. } 24 \text{ lb. } 8 \text{ oz.} = 2184 \text{ oz.}$ and $1 \text{ cwt.} = 1792 \text{ oz.}$ then state it thus, if $1792 \text{ oz.} : 9 \text{ s.} :: 2184 \text{ oz.}$ then $2184 \times 9 = 19656 \text{ s.}$ which divided by 1792, will give $10 \text{ s. } 11 \text{ d. } \frac{1}{2} - 896 \text{ rem.}$ the answer.

(²⁰) Stated thus, if $2184 \text{ oz.} : 10 \text{ s. } 11 \text{ d. } \frac{1}{2} - 896 :: 1792 \text{ oz.}$ then $10 \text{ s. } 11 \text{ d. } \frac{1}{2} - 896 = 526 \text{ qrs.} - 896$, which multiplied by 1792, and divided by 2184, will give $432 \text{ qrs.} = 9 \text{ s.}$ the answer.

(²¹) Stated thus, if $1 \text{ d.} : 232 \text{ d.} = (19 \text{ s. } 4 \text{ d.}) :: 365 \text{ d.}$ then $365 \times 232 = 84680 \text{ d.}$ which divided by 12 and 20, will give $35 \text{ l. } 16 \text{ s. } 8 \text{ d.}$ what the gentleman spent, then $500 \text{ l.} - 35 \text{ l. } 16 \text{ s. } 8 \text{ d.} = 147 \text{ l. } 3 \text{ s. } 4 \text{ d.}$ the answer.

(²²) Stated thus, if $2520 \text{ d.} = (10 \text{ l. } 10 \text{ s.}) : 18\frac{2}{3} \text{ f. e.} = (14 \text{ d.}) :: 68130 \text{ d.} = (283 \text{ l. } 17 \text{ s. } 6 \text{ d.})$ then $68130 \times 18\frac{2}{3} = 1271760$, which divided by 2520 will give 504 f. e. and 2 qrs. the answer.

(²³) Stated thus, if $68130 \text{ d.} : 1514 \text{ qrs.} = (504 \text{ f. e. } 2 \text{ qrs.}) :: 2520 \text{ d.}$ then $1514 \times 2520 = 3815280$, which divided by 68130, will give $56 \text{ qrs.} = 14 \text{ yds.}$ the answer.

(²⁴) Stated thus, if $1514 \text{ qrs.} : 68130 \text{ d.} :: 56 \text{ qrs.}$ then $68130 \times 56 = 3815280 \text{ d.}$ which divided by 1514, 12, and 20, will give $10 \text{ l. } 10 \text{ s.}$ the answer.

(²⁵) Stated thus, if $48 \text{ oz.} = (3 \text{ l.}) : 260 \text{ s.} = (1 \text{ l. } 11 \text{ s. } 8 \text{ d.}) :: 468 \text{ oz.} = (29 \text{ lb. } 4 \text{ oz.})$ then $468 \times 260 = 121680 \text{ d.}$ which being divided by 48, 12, and 20, will give $10 \text{ l. } 11 \text{ s. } 3 \text{ d.}$ the answer.

(²⁶) Stated thus, if $468 \text{ oz.} : 2535 \text{ d.} = (10 \text{ l. } 11 \text{ s. } 3 \text{ d.}) :: 48 \text{ oz.}$ then $2535 \times 48 = 121680 \text{ d.}$ which being divided by 468, 12, and 20, will give $1 \text{ l. } 11 \text{ s. } 8 \text{ d.}$ the answer.

(²⁷) Stated thus, if $6 \text{ qrs. oz.} = (1\frac{1}{2} \text{ oz.}) : 25 \text{ qrs.} = (6\frac{1}{4} \text{ d.}) :: 13 \text{ qrs. oz.} = (3\frac{3}{4} \text{ oz.})$ then $25 \times 13 = 325 \text{ qrs.}$ which being divided by 6, 4, and 12, will give $1 \text{ s. } 1 \text{ d. } \frac{1}{2} - 1$ the answer.

(²⁸) Stated thus, if $7 \text{ qrs.} = (1 \text{ c. e. } 1 \text{ qr.}) : 55 \text{ d.} :: 158 \text{ qrs.} = (39\frac{1}{2} \text{ yds.})$ then $158 \times 55 = 8690 \text{ d.}$ which being divided by 7, 12, and 20, will give $5 \text{ l. } 3 \text{ s. } 5 \text{ d. } \frac{1}{4} - 5$ the answer.

(²⁹) Stated

(²⁹) Stated thus, if $480 \text{ grs.} = (1 \text{ oz.}) : 1250 \text{ l.} = (5 \text{ l. } 4 \text{ s. } 2 \text{ d.})$
 $\therefore 1 \text{ gr. then } 1250 \div 480 = 2 \text{ d. } \frac{1}{2} = 200 \text{ the answer.}$

(³⁰) Stated thus, if $14 \text{ yds.} : 192 \text{ s.} = (9 \text{ l. } 12 \text{ s.}) : 75 \text{ yds.}$
 then $192 \times 75 = 14400 \text{ s.}$ which being divided by 14 and 20,
 will give $5 \text{ l. } 8 \text{ s. } 6 \text{ d. } \frac{3}{4} = 5 \text{ the answer.}$

(³¹) Stated thus, if $1350 \text{ d.} = (5 \text{ l. } 12 \text{ s. } 6 \text{ d.}) : 108 \text{ qrs.} =$
 $(27 \text{ yds.}) : 24000 \text{ d.} = (100 \text{ l.})$ then $24000 \times 108 = 2592000$,
 which being divided by 1350 and 5, will give 384 l. s. the
 answer.

(³²) Stated thus, if $112 \text{ lb.} : 3030 \text{ d.} : 1615 \text{ lb.} = (14 \text{ cwt.}$
 $1 \text{ qr. } 19 \text{ lb.})$ then $3030 \times 1615 = 4893450 \text{ d.}$ which divided
 by 112, 12, and 20, will give $182 \text{ l. os. } 11 \text{ d. } \frac{1}{2} = 8$, the
 answer.

(³³) Stated thus, if $7 \text{ yds.} : 212 \text{ d.} = (17 \text{ s. } 8 \text{ d.}) : 137 \frac{1}{2} \text{ yds.} =$
 $(27 \frac{1}{2} \times 5)$, then $137 \frac{1}{2} \times 212 = 29150 \text{ d.}$ which being divided
 by 7, 12, and 20, will give $17 \text{ l. } 7 \text{ s. } 0 \text{ d. } \frac{1}{4} = 1$, the answer.

(³⁴) Stated thus, if $3624 \text{ gr.} = (7 \text{ oz. } 11 \text{ dwt.}) : 35 \text{ l.} : :$
 $85264 \text{ gr.} = (14 \text{ lb. } 9 \text{ oz. } 12 \text{ dwt. } 16 \text{ gr.})$ then $85264 \times 35 =$
 2984240 which being divided by 3624, will give $823 \text{ l. } 9 \text{ s.}$
 $3 \text{ d. } \frac{3}{4} = 552$, the answer.

(³⁵) Stated thus, if $5 \text{ qrs.} : 178 \frac{3}{4} \text{ d.} = (14 \text{ s. } 10 \text{ d. } \frac{3}{4}) : 1680 \text{ qrs.}$
 $= (420 \text{ yds.})$ then $1680 \times 178 \frac{3}{4} = 300300 \text{ d.}$ which being
 divided by 5, 12, and 20, will give $250 \text{ l. } 5 \text{ s.}$ the answer.

(³⁶) Stated thus, if $3428 \text{ dwts.} = (14 \text{ lb. } 3 \text{ oz. } 8 \text{ dwt.})$
 $: 10284 \text{ s.} = (514 \text{ l. } 4 \text{ s.}) : 20 \text{ dwts.}$ then $10284 \times 20 =$
 205680 s. which being divided by 3428 and 20, will give 3 l.
 the answer.

(³⁷) Stated thus, if $4 \text{ qrs.} : 582 \text{ d.} = (2 \text{ l. } 8 \text{ s. } 6 \text{ d.}) : 106 \text{ qrs.}$
 $= (6 \text{ cwt. } 2 \text{ qrs. } 14 \text{ lb. } \times 4 = 26 \text{ cwt. } 2 \text{ qrs.})$ then $582 \times 106 =$
 61692 d. which being divided by 4, 12, and 20, will give
 $64 \text{ l. } 5 \text{ s. } 3 \text{ d.}$ the answer.

(³⁸) Stated thus, if $6 \text{ yds.} : 96 \text{ s.} = (4 \text{ l. } 16 \text{ s.}) : 8320 \text{ yds.}$
 $= (8 \times 4 \times 10 \times 26)$ then $8320 \times 96 = 798720$, which being
 divided by 6 and 20, will give 6656 l. the answer.

(³⁹) Stated thus, if $24 \text{ lb.} : 6 \text{ s. } 6 \text{ d.} : 1836 \text{ lb.} = (3 \text{ qrs.}$
 $18 \text{ lb. } \times 18 = 16 \text{ cwt. } 1 \text{ qr. } 16 \text{ lb.})$ then $1836 \times 6 \frac{1}{2} = 11934 \text{ s.}$
 which being divided by 24 and 20, will give $24 \text{ l. } 17 \text{ s. } 3 \text{ d.}$
 the answer.

(⁴⁰) Stated thus, if $20 \text{ dwts.} : 5 \text{ s.} : 25060 \text{ dwts.} = (7 \text{ lb.}$
 $5 \text{ oz. } 10 \text{ dwts. } \times 14)$ then $25060 \times 5 = 125300 \text{ s.}$ which being
 divided by 20 and 20, will give $313 \text{ l. } 5 \text{ s.}$ the answer.

(⁴¹) Stated thus, if $14\text{ lb.} : 102d. = (8s. 6d.) :: 271\text{ lb.} =$
 $(2\text{ cwt. } 1\text{ qr. } 19\text{ lb.})$ then $272 \times 102 = 27642d.$ which being
 divided by 14, 12, and 20, will give $8l. 4s. 6d. \frac{1}{4} - 10$ the
 answer.

(⁴²) Stated thus, if $112\text{ lb.} : 688d. = (2l. 17s. 4d.) ::$
 $6688\text{ lb.} = (59\text{ cwt. } 2\text{ qrs. } 24\text{ lb.})$ then $6688 \times 688 =$
 $4601344d.$ which being divided by 112, 12, and 20, will
 give $171l. 3s. 7d. \frac{1}{4} - 80$, the answer.

(⁴³) Stated thus, if $1a. : 15s. 6d. :: 547a.$ then $547 \times$
 $15\frac{1}{2} = 8478s. 6d.$ which being divided by 20 and 2, will give
 $211l. 19s. 3d.$ the half year's rent required.

(⁴⁴) First $171l. \times 14 = 2394l. 0s.$

Charges add $\frac{4}{10}$

Sum $\frac{2398}{10}$ value of the lead.

Stated thus, if $383040\text{ lb.} = (171\text{ ton}) : 575640d. = (2398l. 10s.) :: 1\text{ lb.}$ then $575640 \div 38340 = 1d. \frac{1}{2} - 4320$ the answer.

(⁴⁵) Stated thus, if $40d. : 1p. :: 10380d. = (43l. 5s.)$ then
 $10380d.$ being divided by 40 and 12, will give $21\text{ doz. } 7\frac{1}{2}p.$
 the answer.

(⁴⁶) Stated thus, if $3\text{ lb.} : 17d. :: 329\text{ lb.} = (27\text{ doz. } 5\text{ lb.})$
 then $329 \times 17 = 5593d.$ which being divided by 3, 12, and
 20, will give $7l. 15s. 4d. \frac{1}{4} - 1$, the answer.

(⁴⁷) First $3\text{ lb. } 7\text{ oz. } 14\text{ drs. } 21\text{ gr.} = 20997\text{ gr.}$

Which \times by $\frac{7}{1}$

Gives weight of the 7 ingots $\frac{146979\text{ gr.}}$

then state it thus, if $480\text{ gr.} : 70s. = (3l. 10s.) :: 146979\text{ gr.}$
 then $146979 \times 70 = 10288530s.$ which being divided by 480
 and 20, will give $1071l. 14s. 5\frac{1}{4}d.$ the answer.

(⁴⁸) First $9\frac{1}{2}d \times 11 = 104\frac{1}{2}d.$ what they stand him in per
 day, then state it thus, if $1d. : 104\frac{1}{2}d. :: 365d.$ then $365 \times$
 $104\frac{1}{2} = 38142\frac{1}{2}d.$ which being divided by 12 and 20, will
 give $158l. 18s. 6\frac{1}{2}d.$ the answer.

(⁴⁹) Stated thus, if $58d. = (4s. 10d.) : 1yd. :: 124312d. =$
 $(517l. 19s. 4d.)$ then $124312d.$ being divided by 58, will give
 $2143\text{ yds. } 1\text{ qr. } -14$, again $2143\text{ yds. } 1\text{ qr. } -14 \div 86 = 24\text{ yds.}$
 $3\text{ qrs. } 2\text{ n. } -64 = 19\text{ ells. } 4\text{ qrs. } 2\text{ n.}$ in a piece, and 64 rem.

(⁵⁰) First	200 guineas	=	210	then from	896	17
	40 moidores	=	54		take	264
			Sum	264	leaves	632

what he has to spend per year.

Stated thus, if 365*d.* : 632*l.* 17*s.* :: 1*d.* then 632*l.* 17*s.* being divided by 365, will give 1*l.* 14*s.* 8*d.* -44, the answer.

THE RULE OF THREE INVERSE.

$$(1) \text{ As } 8. : 12 :: 16$$

$$\begin{array}{r} 8 \\ 16 \overline{) 96} \text{ (6 days.} \\ 96 \\ \hline \end{array}$$

$$(2) \text{ As } 90 : 54 :: 50$$

$$\begin{array}{r} 90 \\ 5 \overline{) 486} \text{ 10} \\ 50 \overline{) 486} \text{ 10} \\ 97 \frac{1}{2} \text{ men.} \\ \hline \end{array}$$

(3) Stated thus, if 24*d.* : 8*oz.* :: 18*d.* then $24 \times 8 = 192$ *oz.* which being divided by 18, will give 10*oz.* $10 \frac{2}{3}$ *dr.* the answer.

(4) Stated thus, if 12*s.* : 240*p.* :: 20*s.* then $240 \times 12 = 2880$, which being divided by 20, will give 144, the answer.

(5) Stated thus, if 5*qrs.* : 30*yds.* :: 3*qrs.* then $30 \times 5 = 150$, which being divided by 3, which being divided by 3, will give 50, the answer.

(6) Stated thus, if 200*l.* : 12*m.* :: 150*l.* then $200 \times 12 = 2400$, which being divided by 150, will give 16, the answer.

(7) Stated thus, if 36*m.* : 1200*lb.* :: 24*m.* then $1200 \times 36 = 43200$, which being divided by 24, will give 1800, the answer.

(8) Stated thus, if 12*d.* : 100*w. men* :: 3*d.* then $100 \times 12 = 1200$, which being divided by 3, will give 400, the answer.

(9) Stated thus, if 3*m.* : 1000*fold.* :: 6*m.* then $1000 \times 3 = 3000$, which being divided by 6 will give 500, and as 3 is just equivalent to half 6, it must of consequence be the answer.

(10) Stated thus, if 30*l.* : 100*m.* :: 24*l.* then $100 \times 30 = 3000$, which being divided by 24, will give 125, the answer.

(11) Stated thus, if 12*b.* : 24*d.* :: 16*b.* then $24 \times 12 = 288$, which being divided by 16, will give 18, the answer.

(12) Stated thus, if 7*qrs.* : 4*yds.* :: 3*qrs.* then $4 \times 7 = 28$, which being divided by 3, will give $9 \frac{1}{3}$, the answer.

(13) Stated thus, if 14*m.* : 18*d.* :: 34*m.* then $14 \times 18 = 252$, which being divided by 34, will give 7*d.* 9*b.* 52*m.* -32, the answer.

R 3

(14) Stated

Double Rule of Three.

(¹⁴) Stated thus, if 8 *m.* : 64 *l.* :: 12 *m.* then $64 \times 8 = 512$, which being divided by 12, will give 42 *l.* 13 *s.* 4 *d.* the answer.

(¹⁵) Stated thus, if 5 *qrs.* : $2\frac{1}{2}$ *yds.* :: 3 *qrs.* then $2\frac{1}{2} \times 4 \times 5 = 50$, which being divided by 3, will give $16\frac{2}{3}$ *qrs.* whence $1000 \times 16\frac{2}{3} = 16666\frac{2}{3}$ *qrs.* = 4166 *yds.* 2 *qrs.* 2 *n.* the answer.

THE DOUBLE RULE OF THREE.

b. d. bu.

(¹) Placed thus 14 : 16 : 56
20 : 24 : -

Then by the fourth rule $\frac{56 \times 20 \times 24}{14 \times 16} = 120$, *Ans.*

m. d. ac.

(²) Placed thus, 8 : 14 : 112
- : 10 : 2000

Then by the fifth rule, $\frac{8 \times 14 \times 2000}{112 \times 10} = 200$, *Ans.*

£. mo. £.

(³) Placed thus, 100 : 12 : 6

75 : 9 : -

Then per rule $\frac{6 \times 9 \times 75}{12 \times 100} = 3$ *l.* 7 *s.* 6 *d.* *Ans.*

lb. m. s.

(⁴) Placed thus 336 : 150 : 42

882 : 50 : -

Then per rule $\frac{42 \times 882 \times 50}{336 \times 150} = 1$ *l.* 16 *s.* 9 *d.* *Ans.*

m. d. qu.

(⁵) Placed thus, 136 : 108 : 351

11232 : 56 : -

Then per rule $\frac{351 \times 11232 \times 56}{136 \times 108} = 15031$ *qu.* - 864 *Ans.*

m. d. ac.

(⁶) Placed thus, 8 : 7 : 40

24 : 28 : -

Then per rule $\frac{40 \times 24 \times 28}{8 \times 7} = 480$, *Ans.*

Double Rule of Three.

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(7) Placed thus, $\begin{matrix} m. & d. & s. \\ 8 & : & 5 : 40 \\ 32 & : & 24 : - \end{matrix}$

Then per rule $\frac{40 \times 32 \times 24}{8 \times 5} = 38l. 8s. \text{ Ans.}$

(8) Placed thus, $\begin{matrix} £. & m. & d. \\ 100 & : & 12 : 6 \\ - & : & 9 : 3 \text{ } 7s. \text{ } 6d. \end{matrix}$

Then per rule $\frac{100 \times 12 \times 3l. \text{ } 7s. \text{ } 6d.}{9 \times 6} = 75l. \text{ Ans.}$

(9) Placed thus, $\begin{matrix} fold. & da. & qu. \\ 939 & : & 168 : 351 \\ - & : & 56 : 1404 \end{matrix}$

Then per rule $\frac{939 \times 168 \times 1404}{351 \times 56} = 11268 \text{ Ans.}$

(10) Placed thus, $\begin{matrix} p. & da. & gal. \\ 7 & : & 12 : 3 = 6(2 \text{ kilderkins}) \\ 14 & : & 8 : - \end{matrix}$

Then per rule $\frac{36 \times 14 \times 8}{7 \times 12} = 2 \text{ kil. } 12 \text{ gal. Ans.}$

NOTE. The following examples we shall solve by two statings in the Single Rule of Three, not only for variety's sake, but also to prove the method to be infinitely preferable, either to our Author's, or to that blind ambiguous way, used by some, of placing all the five terms in one line after certain order, and then giving rules for operation according as the question is conceived to belong to the direct or inverse Rule, without considering whether an inverse question involves two indirect statings, or only one. By this method the operation must be suspended while it be discovered, whether the statings are direct or inverse, that thereby it may be observed which of the figures fall in the divisor, and which the multipliers in the dividend

(11) First, $14^l. 10s. = 3480d.$ and $5^l. 8s. 9d. = 1305d.$ then
As $3480d. : 1305d. :: 60cwt. ::$ (1st. *Ans.*)

Again as $20m. : 30m. ::$ 1st. *Ans.* (to the true *Ans.*)

Now here it may be observed, that one of the statings is direct and the other inverse, therefore,

$$\frac{1305 \times 60 \times 20}{3480 \times 30} = \frac{1305}{87} = 15 \text{ cwt. } \textit{Ans.}$$

(12) First, as $1 \text{ qr.} : 300 \text{ qrs.} :: 2 \text{ ho.} ::$ (1st. *Ans.*)

Again as $16 \text{ da.} : 24 \text{ da.} ::$ 1st. *Ans.* (to the true *Ans.*)

Here one of the statings is also direct and the other inverse: whence,

$$\frac{300 \times 2 \times 16}{1 \times 24} = \frac{300 \times 4}{3} = 400 \text{ horses, the } \textit{Ans.}$$

(13) First, as $1 \text{ yr.} : 6 \text{ yr.} :: 7^l. ::$ (1st. *Ans.*)

Again, as $100^l. : 57^l. ::$ 1st. *Ans.* (to the true *Ans.*)

Here both the statings are direct, whence,

$$\frac{6 \times 7 \times 57^l.}{1 \times 100} = 239^l. 16s. 4\frac{3}{4}d. = 20 \text{ } \textit{Ans.}$$

(14) First $2^t. = 40 \text{ cwt.}$, and $12^t. 17 \text{ cwt.} = 257 \text{ cwt.}$ then

As $40 \text{ cwt.} : 257 \text{ cwt.} :: 10s. ::$ (1st. *Ans.*)

Again, as $6m. : 17m. ::$ 1st. *Ans.* (to the true *Ans.*)

Here both the statings are also direct, therefore,

$$\frac{257 \times 10 \times 17}{40 \times 6} = \frac{257 \times 17}{4 \times 6} = 9^l. 2s. 0\frac{1}{2}d. \text{ the } \textit{Ans.}$$

PRACTICE

(1)

PRACTICE.

CASE I.

$$\begin{array}{r}
 \text{lb.} \\
 (1) \frac{1}{4} \text{ is } \frac{1}{4}) 5704 \\
 12) 1426 \\
 1|0) 11|8 \quad 10 \\
 \underline{\underline{\pounds 5 \quad 18 \quad 10}}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \\
 (2) \frac{1}{2} \text{ is } \frac{1}{2}) 7695 \\
 12) 3847\frac{1}{2} \\
 2|0) 32|0 \quad 7 \\
 \underline{\underline{\pounds 16 \quad 0 \quad 7\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \\
 (3) \frac{1}{2} \text{ is } \frac{1}{2}) 5740 \\
 12) 2870 \\
 2|0) 23|9 \quad 2 \\
 \underline{\underline{\pounds 11 \quad 19 \quad 2}}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \\
 (4) \frac{1}{2} \text{ is } \frac{1}{2}) 6547 \\
 \frac{1}{4} \text{ is } \frac{1}{4}) 3273\frac{1}{2} \\
 1636\frac{3}{4} \\
 12) 4910\frac{1}{4} \\
 2|0) 40|9 \quad 2 \\
 \underline{\underline{\pounds 20 \quad 9 \quad 2\frac{1}{4}}}
 \end{array}$$

$$\begin{array}{r}
 \text{lb.} \\
 (5) \frac{1}{2} \text{ is } \frac{1}{2}) 4573 \\
 \frac{1}{4} \text{ is } \frac{1}{4}) 2280\frac{1}{2} \\
 1143\frac{1}{4} \\
 12) 3429\frac{3}{4} \\
 2|0) 28|5 \quad 9 \\
 \underline{\underline{\pounds 14 \quad 5 \quad 9\frac{3}{4}}}
 \end{array}$$

CASE II.

$$(1) \left. \begin{array}{l} 1 \\ 2|0 \end{array} \right\} \begin{array}{r} \frac{1}{12} \\ \hline 7547 \\ 62|8 \quad 11 \\ \hline \pounds 31 \quad 8 \quad 11 \end{array}$$

$$(2) \left. \begin{array}{l} 1 \\ \frac{1}{4} \\ 2|0 \end{array} \right\} \begin{array}{r} \frac{1}{12} \\ \hline 3751 \\ 312 \quad 7 \\ 78 \quad 1\frac{3}{4} \\ \hline 39|0 \quad 8\frac{3}{4} \\ \hline \pounds 19 \quad 10 \quad 8\frac{3}{4} \end{array}$$

(3)	$1 \frac{1}{2}$	$\frac{1}{12} \frac{1}{2}$	$\begin{array}{r} 54325 \\ 4527 \quad 1 \\ \hline 2263 \quad 6\frac{1}{2} \\ 2 0 \quad 679 0 \quad 7\frac{1}{2} \\ \hline \pounds.339 \quad 10 \quad 7\frac{1}{2} \end{array}$	(9)	3	$\frac{1}{4}$	$\begin{array}{r} 2715 \\ 67 8 \quad 9 \\ \hline \pounds.33 \quad 18 \quad 9 \end{array}$	(15)
(4)	$1 \frac{1}{2}$	$\frac{1}{12} \frac{1}{2}$	$\begin{array}{r} 6254 \\ 521 \quad 2 \\ \hline 260 \quad 7 \\ 130 \quad 3\frac{1}{2} \\ 2 0 \quad 91 2 \quad 0\frac{1}{2} \\ \hline \pounds.45 \quad 12 \quad 0\frac{1}{2} \end{array}$	(10)	3	$\frac{1}{4}$	$\begin{array}{r} 7062 \\ 1765 \quad 6 \\ \hline 147 \quad 1\frac{1}{2} \\ 2 0 \quad 191 2 \quad 7\frac{1}{2} \\ \hline \pounds.95 \quad 12 \quad 7\frac{1}{2} \end{array}$	(16)
(5)	2	$\frac{1}{6}$	$\begin{array}{r} 2351 \\ 39 1 \quad 10 \\ \hline \pounds.19 \quad 11 \quad 10 \end{array}$	(11)	3	$\frac{1}{4}$	$\begin{array}{r} 2147 \\ 536 \quad 9 \\ \hline 89 \quad 5\frac{1}{2} \\ 2 0 \quad 62 6 \quad 2\frac{1}{2} \\ \hline \pounds.31 \quad 6 \quad 2\frac{1}{2} \end{array}$	(17)
(6)	2	$\frac{1}{6}$	$\begin{array}{r} 7210 \\ 1201 \quad 8 \\ \hline 150 \quad 2\frac{1}{2} \\ 2 0 \quad 135 1 \quad 10\frac{1}{2} \\ \hline \pounds.67 \quad 11 \quad 10\frac{1}{2} \end{array}$	(12)	3	$\frac{1}{4}$	$\begin{array}{r} 7000 \\ 1750 \\ \hline 291 \quad 8 \\ 145 \quad 10 \\ 2 0 \quad 218 7 \quad 6 \\ \hline \pounds.109 \quad 7 \quad 6 \end{array}$	(18)
(7)	2	$\frac{1}{2}$	$\begin{array}{r} 2710 \\ 451 \quad 8 \\ \hline 112 \quad 11 \\ 2 0 \quad 56 4 \quad 7 \\ \hline \pounds.28 \quad 4 \quad 7 \end{array}$	(13)	4	$\frac{1}{3}$	$\begin{array}{r} 3257 \\ 108 5 \quad 8 \\ \hline \pounds.54 \quad 5 \quad 8 \end{array}$	(19)
(8)	2	$\frac{1}{6}$	$\begin{array}{r} 3250 \\ 541 \quad 8 \\ \hline 135 \quad 5 \\ 67 \quad 8\frac{1}{2} \\ 2 0 \quad 74 4 \quad 9\frac{1}{2} \\ \hline \pounds.37 \quad 4 \quad 9\frac{1}{2} \end{array}$	(14)	4	$\frac{1}{3}$	$\begin{array}{r} 2056 \\ 685 \quad 4 \\ \hline 42 \quad 10 \\ 2 0 \quad 72 8 \quad 2 \\ \hline \pounds.30 \quad 8 \quad 2 \end{array}$	

$$\begin{array}{r}
 (15) \quad 4 \quad \frac{1}{3} \quad 3752 \\
 \frac{1}{2} \quad \frac{1}{8} \quad 1250 \quad 8 \\
 \quad \quad 156 \quad 4 \\
 2|0 \quad 140|7 \quad 0 \\
 \hline
 \pounds.70 \quad 7 \quad 0
 \end{array}$$

$$\begin{array}{r}
 (16) \quad 4 \quad \frac{1}{3} \quad 2107 \\
 \frac{1}{2} \quad \frac{1}{8} \quad 702 \quad 4 \\
 \frac{1}{4} \quad \frac{1}{2} \quad 87 \quad 9\frac{1}{2} \\
 \quad \quad 43 \quad 10\frac{3}{4} \\
 2|0 \quad 83|4 \quad 0\frac{1}{4} \\
 \hline
 \pounds.41 \quad 14 \quad 0\frac{1}{4}
 \end{array}$$

$$\begin{array}{r}
 (17) \quad 4 \quad \frac{1}{3} \quad 3210 \\
 1 \quad \frac{1}{4} \quad 1070 \\
 \quad \quad 267 \quad 6 \\
 2|0 \quad 133|7 \quad 6 \\
 \hline
 \pounds.66 \quad 17 \quad 6
 \end{array}$$

$$\begin{array}{r}
 (18) \quad 4 \quad \frac{1}{3} \quad 2715 \\
 1 \quad \frac{1}{4} \quad 905 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 226 \quad 3 \\
 \quad \quad 56 \quad 6\frac{3}{4} \\
 2|0 \quad 118|7 \quad 9\frac{3}{4} \\
 \hline
 \pounds.19 \quad 7 \quad 9\frac{3}{4}
 \end{array}$$

$$\begin{array}{r}
 (19) \quad 4 \quad \frac{1}{3} \quad 3120 \\
 1 \quad \frac{1}{4} \quad 1040 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 260 \\
 \quad \quad 130 \\
 2|0 \quad 143|0 \\
 \hline
 \pounds.71 \quad 10
 \end{array}$$

$$\begin{array}{r}
 (20) \quad 4 \quad \frac{1}{3} \quad 7521 \\
 1 \quad \frac{1}{4} \quad 2507 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 626 \quad 9 \\
 \frac{1}{4} \quad \frac{1}{2} \quad 313 \quad 4\frac{1}{2} \\
 \quad \quad 156 \quad 8\frac{1}{4} \\
 2|0 \quad 360|3 \quad 9\frac{3}{4} \\
 \hline
 \pounds.100 \quad 3 \quad 9\frac{3}{4}
 \end{array}$$

$$\begin{array}{r}
 (21) \quad 6 \quad \frac{1}{2} \quad 3271 \\
 2|0 \quad 163|5 \quad 6 \\
 \hline
 \pounds.81 \quad 15 \quad 6
 \end{array}$$

$$\begin{array}{r}
 (22) \quad 6 \quad \frac{1}{2} \quad 7914 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 3957 \\
 \quad \quad 164 \quad 10\frac{1}{2} \\
 2|0 \quad 412|1 \quad 10\frac{1}{2} \\
 \hline
 \pounds.206 \quad 1 \quad 10\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (23) \quad 6 \quad \frac{1}{2} \quad 3250 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 1625 \\
 \quad \quad 135 \quad 5 \\
 2|0 \quad 176|0 \quad 5 \\
 \hline
 \pounds.88 \quad 0 \quad 5
 \end{array}$$

$$\begin{array}{r}
 (24) \quad 6 \quad \frac{1}{2} \quad 2708 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 1354 \\
 \frac{1}{4} \quad \frac{1}{2} \quad 112 \quad 10 \\
 \quad \quad 56 \quad 5 \\
 2|0 \quad 152|3 \quad 3 \\
 \hline
 \pounds.76 \quad 3 \quad 3
 \end{array}$$

$$\begin{array}{r}
 (25) \quad 6 \quad \frac{1}{6} \quad \begin{array}{r} 3271 \\ 1635 \quad 6 \\ 272 \quad 7 \\ \hline 190 \quad 8 \quad 1 \\ \hline \pounds .95 \quad 8 \quad 1 \end{array} \\
 1 \quad \frac{1}{6} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (26) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 3254 \\ 1627 \\ 271 \quad 2 \\ 67 \quad 9 \frac{1}{2} \\ \hline 196 \quad 5 \quad 11 \frac{1}{2} \\ \hline \pounds 98 \quad 5 \quad 11 \frac{1}{2} \end{array} \\
 1 \quad \frac{1}{6} \quad \frac{1}{4} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (27) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 2701 \\ 1350 \quad 6 \\ 225 \quad 1 \\ 112 \quad 6 \frac{1}{2} \\ \hline 168 \quad 8 \quad 1 \frac{1}{2} \\ \hline \pounds .84 \quad 8 \quad 1 \frac{1}{2} \end{array} \\
 1 \quad \frac{1}{6} \quad \frac{1}{2} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (28) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 3714 \\ 1857 \\ 309 \quad 6 \\ 154 \quad 9 \\ 77 \quad 4 \frac{1}{2} \\ \hline 239 \quad 8 \quad 7 \frac{1}{2} \\ \hline \pounds 119 \quad 18 \quad 7 \frac{1}{2} \end{array} \\
 1 \quad \frac{1}{6} \quad \frac{1}{2} \quad \frac{1}{4} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (29) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 2710 \\ 1355 \\ 451 \quad 8 \\ \hline 180 \quad 6 \quad 8 \\ \hline \pounds .90 \quad 6 \quad 8 \end{array} \\
 2 \quad \frac{1}{3} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (30) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 3514 \\ 1757 \\ 585 \quad 8 \\ 73 \quad 2 \frac{1}{2} \\ \hline 241 \quad 5 \quad 10 \frac{1}{2} \\ \hline \pounds .120 \quad 15 \quad 10 \frac{1}{2} \end{array} \\
 2 \quad \frac{1}{3} \quad \frac{1}{8} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (31) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 2759 \\ 1379 \quad 6 \\ 459 \quad 10 \\ 114 \quad 11 \frac{1}{2} \\ \hline 195 \quad 4 \quad 3 \frac{1}{2} \\ \hline \pounds 97 \quad 14 \quad 3 \frac{1}{2} \end{array} \\
 2 \quad \frac{1}{3} \quad \frac{1}{4} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (32) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 9872 \\ 4936 \\ 1645 \quad 4 \\ 411 \quad 4 \\ 205 \quad 8 \\ \hline 719 \quad 8 \quad 4 \\ \hline \pounds 359 \quad 18 \quad 4 \end{array} \\
 2 \quad \frac{1}{3} \quad \frac{1}{4} \quad \frac{1}{2} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (33) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 5272 \\ 2636 \\ 1318 \\ \hline 395 \quad 4 \\ \hline \pounds .197 \quad 14 \end{array} \\
 3 \quad \frac{1}{2} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (34) \quad 6 \quad \frac{1}{2} \quad \begin{array}{r} 6325 \\ 3162 \quad 6 \\ 1581 \quad 3 \\ 131 \quad 9 \frac{1}{4} \\ \hline 487 \quad 5 \quad 6 \frac{1}{4} \\ \hline \pounds .243 \quad 15 \quad 6 \frac{1}{4} \end{array} \\
 3 \quad \frac{1}{2} \quad \frac{1}{4} \\
 2 \mid 0
 \end{array}$$

$$\begin{array}{r}
 (35) \quad 6 \quad \frac{1}{2} \quad \underline{7924} \\
 3 \quad \frac{1}{2} \quad \frac{1}{6} \quad \underline{3962} \\
 \frac{1}{2} \quad \underline{1981} \\
 \quad \quad \underline{330} \quad 2 \\
 2|0 \quad \underline{627|3} \quad 2 \\
 \quad \quad \underline{\underline{\pounds.313 \quad 13 \quad 2}}
 \end{array}$$

$$\begin{array}{r}
 (36) \quad 6 \quad \frac{1}{2} \quad \underline{2150} \\
 3 \quad \frac{1}{2} \quad \frac{1}{6} \quad \underline{1075} \\
 \frac{1}{2} \quad \frac{1}{4} \quad \underline{537} \quad 6 \\
 \quad \quad \underline{89} \quad 7 \\
 \quad \quad \underline{44} \quad 9\frac{1}{2} \\
 2|0 \quad \underline{174|6} \quad 10\frac{1}{2} \\
 \quad \quad \underline{\underline{\pounds.87 \quad 6 \quad 10\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (37) \quad 6 \quad \frac{1}{2} \quad \underline{6325} \\
 3 \quad \frac{1}{2} \quad \underline{3162} \quad 6 \\
 1 \quad \frac{1}{3} \quad \underline{1581} \quad 3 \\
 \quad \quad \underline{527} \quad 1 \\
 2|0 \quad \underline{527|0} \quad 10 \\
 \quad \quad \underline{\underline{\pounds.263 \quad 10 \quad 10}}
 \end{array}$$

$$\begin{array}{r}
 (38) \quad 6 \quad \frac{1}{2} \quad \underline{5724} \\
 3 \quad \frac{1}{2} \quad \underline{2862} \\
 1 \quad \frac{1}{4} \quad \underline{1431} \\
 \frac{1}{4} \quad \underline{477} \\
 \quad \quad \underline{119} \quad 3 \\
 2|0 \quad \underline{488|9} \quad 3 \\
 \quad \quad \underline{\underline{\pounds.244 \quad 9 \quad 3}}
 \end{array}$$

$$\begin{array}{r}
 (39) \quad 6 \quad \frac{1}{2} \quad \underline{6327} \\
 3 \quad \frac{1}{2} \quad \underline{3163} \quad 6 \\
 1 \quad \frac{1}{4} \quad \underline{1581} \quad 9 \\
 \frac{1}{4} \quad \underline{527} \quad 3 \\
 \quad \quad \underline{131} \quad 9\frac{3}{4} \\
 2|0 \quad \underline{540|4} \quad 3\frac{3}{4} \\
 \quad \quad \underline{\underline{\pounds.270 \quad 4 \quad 3\frac{3}{4}}}
 \end{array}$$

$$\begin{array}{r}
 (40) \quad 6 \quad \frac{1}{2} \quad \underline{3254} \\
 3 \quad \frac{1}{2} \quad \underline{1627} \\
 1 \quad \frac{1}{2} \quad \underline{813} \quad 6 \\
 \frac{1}{2} \quad \underline{271} \quad 2 \\
 \quad \quad \underline{135} \quad 7 \\
 2|0 \quad \underline{284|7} \quad 3 \\
 \quad \quad \underline{\underline{\pounds.142 \quad 7 \quad 3}}
 \end{array}$$

$$\begin{array}{r}
 (41) \quad 6 \quad \frac{1}{2} \quad \underline{7291} \\
 3 \quad \frac{1}{2} \quad \underline{3645} \quad 6 \\
 1 \quad \frac{1}{3} \quad \underline{1822} \quad 9 \\
 \frac{1}{2} \quad \frac{1}{4} \quad \underline{607} \quad 7 \\
 \quad \quad \underline{303} \quad 9\frac{1}{2} \\
 \quad \quad \underline{151} \quad 10\frac{3}{4} \\
 2|0 \quad \underline{653|1} \quad 6\frac{1}{4} \\
 \quad \quad \underline{\underline{\pounds.326 \quad 11 \quad 6\frac{1}{4}}}
 \end{array}$$

$$\begin{array}{r}
 (42) \quad 6 \quad \frac{1}{2} \quad \underline{3256} \\
 3 \quad \frac{1}{2} \quad \underline{1628} \\
 2 \quad \frac{1}{3} \quad \underline{814} \\
 \quad \quad \underline{542} \quad 8 \\
 2|0 \quad \underline{298|4} \quad 8 \\
 \quad \quad \underline{\underline{\pounds.149 \quad 4 \quad 8}}
 \end{array}$$

$$\begin{array}{r}
 (43) \quad 6 \quad \frac{1}{2} \quad \underline{7254} \\
 3 \quad \frac{1}{2} \quad \underline{3627} \\
 2 \quad \frac{1}{3} \quad \underline{1813} \quad 6 \\
 \frac{1}{4} \quad \underline{1209} \\
 \quad \quad \underline{151} \quad 1\frac{1}{2} \\
 2|0 \quad \underline{680|0} \quad 7\frac{1}{2} \\
 \quad \quad \underline{\underline{\pounds.340 \quad 0 \quad 7\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r|l}
 (44) \quad 6 \quad \frac{1}{2} & 3754 \\
 3 \quad \frac{1}{2} & 1877 \\
 1 \quad \frac{1}{3} & 938 \quad 6 \\
 \text{do.} & 312 \quad 10 \\
 1 \quad \frac{1}{2} & 312 \quad 10 \\
 \frac{1}{2} & 156 \quad 5 \\
 2|0 & \underline{359|7 \quad 7} \\
 & \underline{\underline{\pounds. 179 \quad 17 \quad 7}}
 \end{array}$$

$$\begin{array}{r|l}
 (45) \quad 6 \quad \frac{1}{2} & 7972 \\
 3 \quad \frac{1}{2} & 3986 \\
 1 \quad \frac{1}{3} & 1993 \\
 \text{do.} & 604 \quad 4 \\
 1 \quad \frac{1}{2} & 664 \quad 4 \\
 \frac{1}{2} & 332 \quad 2 \\
 \frac{1}{4} & 166 \quad 1 \\
 2|0 & \underline{780|5 \quad 11} \\
 & \underline{\underline{\pounds. 390 \quad 5 \quad 11}}
 \end{array}$$

CASE III.

$$\begin{array}{r|l}
 (1) \quad \frac{1}{4} \quad \frac{1}{48} & 2106 \\
 & 43 \quad 10\frac{1}{2} \\
 2|0 & \underline{214|9 \quad 10\frac{1}{2}} \\
 & \underline{\underline{\pounds. 107 \quad 9 \quad 10\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r|l}
 (5) \quad 1 \quad \frac{1}{12} & 3215 \\
 \frac{1}{4} \quad \frac{1}{4} & 267 \quad 11 \\
 & 66 \quad 11\frac{3}{4} \\
 2|0 & \underline{354|9 \quad 10\frac{3}{4}} \\
 & \underline{\underline{\pounds. 177 \quad 9 \quad 10\frac{3}{4}}}
 \end{array}$$

$$\begin{array}{r|l}
 (2) \quad \frac{1}{2} \quad \frac{1}{24} & 3715 \\
 & 154 \quad 9\frac{1}{2} \\
 2|0 & \underline{386|9 \quad 9\frac{1}{2}} \\
 & \underline{\underline{\pounds. 193 \quad 9 \quad 9\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r|l}
 (6) \quad 1 \quad \frac{1}{12} & 2790 \\
 \frac{1}{2} \quad \frac{1}{2} & 232 \quad 6 \\
 & 116 \quad 3 \\
 2|0 & \underline{313|8 \quad 9} \\
 & \underline{\underline{\pounds. 156 \quad 18 \quad 9}}
 \end{array}$$

$$\begin{array}{r|l}
 (3) \quad \frac{1}{2} \quad \frac{1}{24} & 2712 \\
 \frac{1}{4} \quad \frac{1}{2} & 112 \\
 & 56 \quad 6 \\
 2|0 & \underline{288|1 \quad 6} \\
 & \underline{\underline{\pounds. 144 \quad 1 \quad 6}}
 \end{array}$$

$$\begin{array}{r|l}
 (7) \quad 1 \quad \frac{1}{12} & 7904 \\
 \frac{1}{2} \quad \frac{1}{2} & 658 \quad 8 \\
 \frac{1}{4} \quad \frac{1}{2} & 329 \quad 4 \\
 & 164 \quad 8 \\
 2|0 & \underline{905|6 \quad 8} \\
 & \underline{\underline{\pounds. 452 \quad 16 \quad 8}}
 \end{array}$$

$$\begin{array}{r|l}
 (4) \quad 1 \quad \frac{1}{12} & 2107 \\
 & 175 \quad 7 \\
 2|0 & \underline{228|2 \quad 7} \\
 & \underline{\underline{\pounds. 114 \quad 2 \quad 7}}
 \end{array}$$

$$\begin{array}{r}
 (8) \quad 2 \frac{1}{8} \quad 3750 \\
 \quad \quad \quad 625 \\
 2|0 \quad \underline{4375} \\
 \text{£.} \underline{\underline{218 \ 15}}
 \end{array}$$

$$\begin{array}{r}
 (9) \quad 2 \frac{1}{8} \quad 3291 \\
 \quad \quad \frac{1}{4} \quad \frac{1}{8} \quad 548 \ 6 \\
 \quad \quad \quad 68 \ 6\frac{1}{2} \\
 2|0 \quad \underline{390|8 \ 0\frac{3}{4}} \\
 \quad \quad \underline{195 \ 8 \ 0\frac{3}{4}}
 \end{array}$$

$$\begin{array}{r}
 (10) \quad 2 \frac{1}{8} \quad 9254 \\
 \quad \quad \frac{1}{2} \quad \frac{1}{4} \quad 1542 \ 4 \\
 \quad \quad \quad 385 \ 7 \\
 2|0 \quad \underline{1118|1 \ 11} \\
 \text{£.} \underline{\underline{559 \ 111}}
 \end{array}$$

$$\begin{array}{r}
 (11) \quad 2 \frac{1}{8} \quad 7250 \\
 \quad \quad \frac{1}{2} \quad \frac{1}{4} \quad 1208 \ 4 \\
 \quad \quad \quad \frac{1}{2} \quad 302 \ 1 \\
 \quad \quad \quad 151 \ 0\frac{1}{2} \\
 2|0 \quad \underline{891|1 \ 5\frac{1}{2}} \\
 \text{£.} \underline{\underline{445 \ 11 \ 5\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (12) \quad 3 \frac{1}{4} \quad 7591 \\
 \quad \quad \quad 1897 \ 9 \\
 2 \ 0 \quad \underline{948|8 \ 9} \\
 \text{£.} \underline{\underline{474 \ 8 \ 9}}
 \end{array}$$

$$\begin{array}{r}
 (13) \quad 3 \frac{1}{4} \quad 6325 \\
 \quad \quad \frac{1}{2} \quad \frac{1}{4} \quad 1581 \ 3 \\
 \quad \quad \quad 131 \ 9\frac{1}{4} \\
 2|0 \quad \underline{803|8 \ 0\frac{1}{4}} \\
 \text{£.} \underline{\underline{401 \ 18 \ 0\frac{1}{4}}}
 \end{array}$$

$$\begin{array}{r}
 (14) \quad 3 \frac{1}{2} \quad 5271 \\
 \quad \quad \frac{1}{8} \quad 1317 \ 9 \\
 \quad \quad \quad 219 \ 7\frac{1}{2} \\
 2|0 \quad \underline{680|8 \ 4\frac{1}{2}} \\
 \text{£.} \underline{\underline{340 \ 8 \ 4\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (15) \quad 3 \frac{1}{4} \quad 3254 \\
 \quad \quad \frac{1}{2} \quad \frac{1}{8} \quad 813 \ 6 \\
 \quad \quad \quad \frac{1}{2} \quad 135 \ 7 \\
 \quad \quad \quad 67 \ 9\frac{1}{2} \\
 2|0 \quad \underline{427|0 \ 10\frac{1}{2}} \\
 \text{£.} \underline{\underline{213 \ 10 \ 10\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (16) \quad 4 \frac{1}{3} \quad 2915 \\
 \quad \quad \quad 971 \ 8 \\
 2|0 \quad \underline{388|6 \ 8} \\
 \text{£.} \underline{\underline{194 \ 6 \ 8}}
 \end{array}$$

$$\begin{array}{r}
 (17) \quad 4 \frac{1}{4} \quad 3270 \\
 \quad \quad \frac{1}{8} \quad 1090 \\
 \quad \quad \quad 68 \ 1\frac{1}{2} \\
 2|0 \quad \underline{442|8 \ 1\frac{1}{2}} \\
 \text{£.} \underline{\underline{221 \ 8 \ 1\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (18) \quad 4 \frac{1}{2} \quad 7059 \\
 \quad \quad \frac{1}{8} \quad 2353 \\
 \quad \quad \quad 294 \ 1\frac{1}{2} \\
 2|0 \quad \underline{970|6 \ 1\frac{1}{2}} \\
 \text{£.} \underline{\underline{485 \ 6 \ 1\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (19) \quad 4 \frac{1}{2} \quad 2750 \\
 \quad \quad \frac{1}{4} \quad \frac{1}{8} \quad 916 \ 8 \\
 \quad \quad \quad \frac{1}{2} \quad 114 \ 7 \\
 \quad \quad \quad 57 \ 3\frac{1}{2} \\
 2|0 \quad \underline{333|8 \ 6\frac{1}{2}} \\
 \text{£.} \underline{\underline{191 \ 18 \ 6\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (20) \quad 4 \quad \frac{1}{3} \quad 3725 \\
 1 \quad \frac{1}{4} \quad 1241 \quad 8 \\
 \hline
 310 \quad 5 \\
 2|0 \quad 527|7 \quad 1 \\
 \hline
 \text{£. } 263 \quad 17 \quad 1
 \end{array}$$

$$\begin{array}{r}
 (25) \quad 6 \quad \frac{1}{2} \quad 7103 \\
 \frac{1}{4} \quad \frac{1}{24} \quad 3551 \quad 6 \\
 \hline
 147 \quad 11\frac{3}{4} \\
 2|0 \quad 1080|2 \quad 5\frac{3}{4} \\
 \hline
 \text{£. } 540 \quad 2 \quad 5\frac{3}{4}
 \end{array}$$

$$\begin{array}{r}
 (21) \quad 4 \quad \frac{1}{3} \quad 7250 \\
 1 \quad \frac{1}{4} \quad 2416 \quad 8 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 604 \quad 2 \\
 \hline
 151 \quad 0\frac{1}{2} \\
 2|0 \quad 1042|1 \quad 10\frac{1}{2} \\
 \hline
 \text{£. } 521 \quad 1 \quad 10\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (26) \quad 6 \quad \frac{1}{2} \quad 3254 \\
 \frac{1}{2} \quad \frac{1}{12} \quad 1627 \\
 \hline
 135 \quad 7 \\
 2|0 \quad 501|6 \quad 7 \\
 \hline
 \text{£. } 250 \quad 16 \quad 7
 \end{array}$$

$$\begin{array}{r}
 (22) \quad 4 \quad \frac{1}{3} \quad 2597 \\
 1 \quad \frac{1}{4} \quad 865 \quad 8 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 216 \quad 5 \\
 \hline
 108 \quad 2\frac{1}{2} \\
 2|0 \quad 378|7 \quad 3\frac{1}{2} \\
 \hline
 \text{£. } 189 \quad 7 \quad 3\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (27) \quad 6 \quad \frac{1}{2} \quad 7925 \\
 \frac{1}{2} \quad \frac{1}{12} \quad 3962 \quad 6 \\
 \frac{1}{4} \quad \frac{1}{2} \quad 330 \quad 2\frac{1}{2} \\
 \hline
 165 \quad 1\frac{1}{4} \\
 2|0 \quad 1238|2 \quad 9\frac{3}{4} \\
 \hline
 \text{£. } 619 \quad 2 \quad 9\frac{3}{4}
 \end{array}$$

$$\begin{array}{r}
 (23) \quad 4 \quad \frac{1}{3} \quad 7210 \\
 1 \quad \frac{1}{4} \quad 2403 \quad 4 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 600 \quad 10 \\
 \frac{1}{4} \quad \frac{1}{2} \quad 300 \quad 5 \\
 \hline
 150 \quad 2\frac{1}{2} \\
 2|0 \quad 1066|4 \quad 9\frac{1}{2} \\
 \hline
 \text{£. } 533 \quad 4 \quad 9\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (28) \quad 6 \quad \frac{1}{2} \quad 9271 \\
 1 \quad \frac{1}{6} \quad 4635 \quad 6 \\
 \hline
 772 \quad 7 \\
 2|0 \quad 1467|9 \quad 1 \\
 \hline
 \text{£. } 733 \quad 19 \quad 1
 \end{array}$$

$$\begin{array}{r}
 (24) \quad 6 \quad \frac{1}{2} \quad 7524 \\
 \hline
 3762 \\
 2|0 \quad 1128|6 \\
 \hline
 \text{£. } 564 \quad 6
 \end{array}$$

$$\begin{array}{r}
 (29) \quad 6 \quad \frac{1}{2} \quad 7210 \\
 1 \quad \frac{1}{3} \quad 3605 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 600 \quad 10 \\
 \hline
 150 \quad 2\frac{1}{2} \\
 2|0 \quad 1156|6 \quad 0\frac{1}{2} \\
 \hline
 \text{£. } 578 \quad 6 \quad 0\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (30) \quad 6 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \\
 \begin{array}{r}
 2310 \\
 1155 \\
 192 \quad 6 \\
 \underline{96 \quad 3} \\
 2|0 \quad 375|3 \quad 9 \\
 \underline{\underline{\pounds.187 \quad 13 \quad 9}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (31) \quad 6 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \\
 \begin{array}{r}
 2504 \\
 1252 \\
 208 \quad 8 \\
 104 \quad 4 \\
 \underline{52 \quad 2} \\
 2|0 \quad 412|1 \quad 2 \\
 \underline{\underline{\pounds.206 \quad 1 \quad 2}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (32) \quad 6 \quad \frac{1}{2} \quad 1 \quad \frac{1}{2} \quad 2 \\
 \begin{array}{r}
 1752 \\
 876 \\
 \underline{292} \\
 2|0 \quad 292|0 \\
 \underline{\underline{\pounds.146 \quad 0}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (33) \quad 6 \quad \frac{1}{2} \quad 2 \quad \frac{1}{3} \quad \frac{1}{4} \quad \frac{1}{8} \\
 \begin{array}{r}
 2905 \\
 1452 \quad 6 \\
 484 \quad 2 \\
 \underline{60 \quad 6\frac{1}{4}} \\
 2|0 \quad 490|2 \quad 2\frac{1}{4} \\
 \underline{\underline{\pounds.245 \quad 2 \quad 2\frac{1}{4}}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (34) \quad 6 \quad \frac{1}{2} \quad 2 \quad \frac{1}{3} \quad \frac{1}{4} \quad \frac{1}{2} \\
 \begin{array}{r}
 7104 \\
 3552 \\
 1184 \\
 \underline{296} \\
 2|0 \quad 1213|6 \\
 \underline{\underline{\pounds.606 \quad 16}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (35) \quad 6 \quad \frac{1}{2} \quad 2 \quad \frac{1}{3} \quad \frac{1}{4} \quad \frac{1}{2} \\
 \begin{array}{r}
 1004 \\
 502 \\
 167 \quad 4 \\
 41 \quad 10 \\
 \underline{20 \quad 11} \\
 2|0 \quad 173|6 \quad 1 \\
 \underline{\underline{\pounds.86 \quad 16 \quad 1}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (36) \quad 6 \quad \frac{1}{2} \quad 3 \quad \frac{1}{2} \\
 \begin{array}{r}
 2104 \\
 1052 \\
 \underline{526} \\
 2|0 \quad 368|2 \\
 \underline{\underline{\pounds.184 \quad 2}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (37) \quad 6 \quad \frac{1}{2} \quad 3 \quad \frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{2} \\
 \begin{array}{r}
 2571 \\
 1285 \quad 6 \\
 642 \quad 9 \\
 \underline{53 \quad 6\frac{3}{4}} \\
 2|0 \quad 455|2 \quad 9\frac{3}{4} \\
 \underline{\underline{\pounds.227 \quad 12 \quad 9\frac{3}{4}}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (38) \quad 6 \quad \frac{1}{2} \quad 3 \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{8} \\
 \begin{array}{r}
 2104 \\
 1052 \\
 526 \\
 87 \quad 8 \\
 2|0 \quad 376|9 \quad 8 \\
 \underline{\underline{\pounds.188 \quad 9 \quad 8}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (39) \quad 6 \quad \frac{1}{2} \quad 3 \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{2} \\
 \begin{array}{r}
 7506 \\
 3753 \\
 1876 \quad 6 \\
 312 \quad 9 \\
 \underline{156 \quad 4\frac{1}{2}} \\
 2|0 \quad 1360|4 \quad 7\frac{1}{2} \\
 \underline{\underline{\pounds.680 \quad 4 \quad 7\frac{1}{2}}}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (40) \quad 6 \quad \frac{1}{2} \quad 1071 \\
 3 \quad \frac{1}{2} \quad 535 \quad 6 \\
 1 \quad \frac{1}{3} \quad 267 \quad 9 \\
 \quad \quad 89 \quad 3 \\
 2|0 \quad \underline{196|3} \quad 6 \\
 \quad \quad \underline{\pounds. 98 \quad 3 \quad 6}
 \end{array}$$

$$\begin{array}{r}
 (41) \quad 6 \quad \frac{1}{2} \quad 5200 \\
 3 \quad \frac{1}{2} \quad 2600 \\
 1 \quad \frac{1}{3} \quad 1300 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 433 \quad 4 \\
 \quad \quad 108 \quad 4 \\
 2|0 \quad \underline{964|1} \quad 8 \\
 \quad \quad \underline{\pounds. 482 \quad 1 \quad 8}
 \end{array}$$

$$\begin{array}{r}
 (42) \quad 6 \quad \frac{1}{2} \quad 2117 \\
 3 \quad \frac{1}{2} \quad 1058 \quad 6 \\
 1 \quad \frac{1}{2} \quad 529 \quad 3 \\
 \frac{3}{2} \quad \frac{1}{2} \quad 176 \quad 5 \\
 \quad \quad 88 \quad 2\frac{1}{2} \\
 2|0 \quad \underline{396|9} \quad 4\frac{1}{2} \\
 \quad \quad \underline{\pounds. 198 \quad 9 \quad 4\frac{1}{2}}
 \end{array}$$

$$\begin{array}{r}
 (43) \quad 6 \quad \frac{1}{2} \quad 1007 \\
 3 \quad \frac{1}{2} \quad 503 \quad 6 \\
 1 \quad \frac{1}{3} \quad 251 \quad 9 \\
 \frac{1}{2} \quad \frac{1}{2} \quad 83 \quad 11 \\
 \quad \quad 41 \quad 11\frac{1}{2} \\
 \quad \quad 20 \quad 11\frac{3}{4} \\
 2|0 \quad \underline{190|9} \quad 1\frac{1}{2} \\
 \quad \quad \underline{\pounds. 95 \quad 9 \quad 1\frac{1}{2}}
 \end{array}$$

$$\begin{array}{r}
 (44) \quad 6 \quad \frac{1}{2} \quad 5000 \\
 3 \quad \frac{1}{2} \quad 2500 \\
 2 \quad \frac{1}{3} \quad 1250 \\
 \quad \quad 833 \quad 4 \\
 2|0 \quad \underline{958|3} \quad 4 \\
 \quad \quad \underline{\pounds. 479 \quad 3 \quad 4}
 \end{array}$$

$$\begin{array}{r}
 (45) \quad 6 \quad \frac{1}{2} \quad 2105 \\
 3 \quad \frac{1}{2} \quad 1052 \quad 6 \\
 2 \quad \frac{1}{3} \quad 526 \quad 3 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 350 \quad 10 \\
 \quad \quad 43 \quad 10\frac{1}{4} \\
 2|0 \quad \underline{407|8} \quad 5\frac{1}{2} \\
 \quad \quad \underline{\pounds. 203 \quad 18 \quad 5\frac{1}{2}}
 \end{array}$$

$$\begin{array}{r}
 (46) \quad 6 \quad \frac{1}{2} \quad 1006 \\
 3 \quad \frac{1}{2} \quad 503 \\
 2 \quad \frac{1}{3} \quad 251 \quad 6 \\
 \frac{1}{2} \quad \frac{1}{4} \quad 167 \quad 8 \\
 \quad \quad 41 \quad 11 \\
 2|0 \quad \underline{197|0} \quad 1 \\
 \quad \quad \underline{\pounds. 98 \quad 10 \quad 1}
 \end{array}$$

$$\begin{array}{r}
 (47) \quad 6 \quad \frac{1}{2} \quad 2705 \\
 3 \quad \frac{1}{2} \quad 1352 \quad 6 \\
 2 \quad \frac{1}{3} \quad 676 \quad 3 \\
 \frac{3}{2} \quad \frac{1}{4} \quad 450 \quad 10 \\
 \quad \quad 112 \quad 8\frac{1}{2} \\
 \quad \quad 56 \quad 4\frac{1}{2} \\
 2|0 \quad \underline{535|3} \quad 7\frac{3}{4} \\
 \quad \quad \underline{\pounds. 267 \quad 13 \quad 7\frac{3}{4}}
 \end{array}$$

$$\begin{array}{r}
 (4) \quad \begin{array}{l} 6 \\ 3 \\ 2 \\ 2 \\ 1 \\ 4 \end{array} \begin{array}{l} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{4} \end{array} \begin{array}{l} 5000 \\ 2500 \\ 1250 \\ 833 \\ 208 \\ 979 \end{array} \begin{array}{l} \\ \\ \\ 4 \\ 4 \\ 8 \end{array} \\
 \hline
 2|0 \quad 979|1 \quad 8 \\
 \hline
 \pounds. 489 \quad 11 \quad 8
 \end{array}$$

$$\begin{array}{r}
 (4) \quad \begin{array}{l} 6 \\ 3 \\ 2 \\ 2 \\ 1 \\ 2 \end{array} \begin{array}{l} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{4} \\ \frac{1}{4} \\ \frac{1}{2} \end{array} \begin{array}{l} 4000 \\ 2000 \\ 1000 \\ 666 \\ 166 \\ 83 \end{array} \begin{array}{l} \\ \\ \\ 8 \\ 8 \\ 4 \end{array} \\
 \hline
 2|0 \quad 791|6 \quad 8 \\
 \hline
 \pounds. 395 \quad 16 \quad 8
 \end{array}$$

CASE IV.

$$\begin{array}{r}
 (1) \quad 2750 \\
 \hline
 \pounds. 2750
 \end{array}$$

$$\begin{array}{r}
 (4) \quad 1572 \\
 \hline
 \pounds. 628|8
 \end{array}$$

$$\begin{array}{r}
 (7) \quad 5271 \\
 \hline
 \pounds. 3689|7 \\
 \hline
 2 \\
 14s.
 \end{array}$$

$$\begin{array}{r}
 (2) \quad 3254 \\
 \hline
 \pounds. 650|8 \\
 \hline
 2 \\
 16s.
 \end{array}$$

$$\begin{array}{r}
 (5) \quad 2102 \\
 \hline
 \pounds. 1051
 \end{array}$$

$$\begin{array}{r}
 (8) \quad 3123 \\
 \hline
 \pounds. 2498|4 \\
 \hline
 2 \\
 8s.
 \end{array}$$

$$\begin{array}{r}
 (3) \quad 2710 \\
 \hline
 \pounds. 813|0
 \end{array}$$

$$\begin{array}{r}
 (6) \quad 2101 \\
 \hline
 \pounds. 1260|6 \\
 \hline
 2 \\
 12s.
 \end{array}$$

$$\begin{array}{r}
 (9) \quad 1075 \\
 \hline
 \pounds. 860|0
 \end{array}$$

$$\begin{array}{r}
 (10) \quad 1621 \\
 \hline
 \pounds. 1458|9 \\
 \hline
 2 \\
 18s.
 \end{array}$$

CASE V.

$$\begin{array}{r} (1) \quad 2 \overline{) 0} 270 \overline{) 3} \\ \underline{\text{£. } 135 \cdot 3} \end{array}$$

$$\begin{array}{r} (5) \quad 3214 \\ \quad \quad 9 \\ 2 \overline{) 0} 2892 \overline{) 6} \\ \underline{\text{£. } 1446 \cdot 6} \end{array}$$

$$\begin{array}{r} (9) \quad 3142 \\ \quad \quad 17 \\ 2 \overline{) 0} 5341 \overline{) 4} \\ \underline{\text{£. } 2670 \cdot 14} \end{array}$$

$$\begin{array}{r} (2) \quad 3270 \\ \quad \quad 3 \\ 2 \overline{) 0} 981 \overline{) 0} \\ \underline{\text{£. } 490 \cdot 10} \end{array}$$

$$\begin{array}{r} (6) \quad 2710 \\ \quad \quad 11 \\ 2 \overline{) 0} 2981 \overline{) 0} \\ \underline{\text{£. } 1490 \cdot 10} \end{array}$$

$$\begin{array}{r} (10) \quad 2150 \\ \quad \quad 19 \\ 2 \overline{) 0} 4085 \overline{) 0} \\ \underline{\text{£. } 2042 \cdot 10} \end{array}$$

$$\begin{array}{r} (3) \quad 3271 \\ \quad \quad 5 \\ 2 \overline{) 0} 1635 \overline{) 5} \\ \underline{\text{£. } 817 \cdot 15} \end{array}$$

$$\begin{array}{r} (7) \quad 3179 \\ \quad \quad 13 \\ 2 \overline{) 0} 4132 \overline{) 7} \\ \underline{\text{£. } 2066 \cdot 7} \end{array}$$

$$\begin{array}{r} (11) \quad 7157 \\ \quad \quad 19 \\ 2 \overline{) 0} 13598 \overline{) 3} \\ \underline{\text{£. } 6799 \cdot 3} \end{array}$$

$$\begin{array}{r} (4) \quad 2715 \\ \quad \quad 7 \\ 2 \overline{) 0} 1900 \overline{) 5} \\ \underline{\text{£. } 950 \cdot 5} \end{array}$$

$$\begin{array}{r} (8) \quad 2150 \\ \quad \quad 15 \\ 2 \overline{) 0} 3225 \overline{) 0} \\ \underline{\text{£. } 1612 \cdot 10} \end{array}$$

CASE VI.

$$\begin{array}{r} s. d. \\ (1) \quad 6 \quad 8 \quad \frac{1}{3} \quad \left| \quad \begin{array}{r} 2710 \\ \underline{\text{£. } 903 \cdot 6 \cdot 8} \end{array} \right. \end{array}$$

$$\begin{array}{r} s. d. \\ (2) \quad 3 \quad 4 \quad \frac{1}{8} \quad \left| \quad \begin{array}{r} 3150 \\ \underline{\text{£. } 525} \end{array} \right. \end{array}$$

$$\begin{array}{r} s. d. \\ (3) \quad 2 \quad 6 \quad \frac{1}{8} \quad \left| \quad \begin{array}{r} 2715 \\ \underline{\text{£. } 339 \cdot 7 \cdot 6} \end{array} \right. \end{array}$$

$$\begin{array}{r} s. d. \\ (4) \quad 1 \quad 8 \quad \frac{1}{12} \quad \left| \quad \begin{array}{r} 7150 \\ \underline{\text{£. } 595 \cdot 16 \cdot 8} \end{array} \right. \end{array}$$

$$\begin{array}{r} s. d. \\ (5) \quad 1 \quad 4 \quad \frac{1}{13} \quad \left| \quad \begin{array}{r} 3215 \\ \underline{\text{£. } 214 \cdot 6 \cdot 8} \end{array} \right. \end{array}$$

$$\begin{array}{r} s. d. \\ (6) \quad 1 \quad 3 \quad \frac{1}{16} \quad \left| \quad \begin{array}{r} 7211 \\ \underline{\text{£. } 450 \cdot 13 \cdot 9} \end{array} \right. \end{array}$$

$$\begin{array}{r}
 (7) \quad 2 \quad \frac{1}{6} \quad 2710 \\
 \quad \quad \quad 3 \\
 \quad \quad \quad \hline
 \quad \quad \quad 8130 \\
 \quad \quad \quad 451 \quad 8 \\
 2|0 \quad \hline
 \quad \quad 858|1 \quad 8 \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 429 \quad 1 \quad 8}}
 \end{array}$$

$$\begin{array}{r}
 (11) \quad 6 \quad \frac{1}{2} \quad 3271 \\
 \quad \quad \quad 5 \\
 \quad \quad \quad \hline
 \quad \quad \quad 16355 \\
 \quad \quad \quad 1635 \quad 6 \\
 \quad \quad \quad 817 \quad 9 \\
 \quad \quad \quad 136 \quad 3\frac{1}{2} \\
 2|0 \quad \hline
 \quad \quad 1894|4 \quad 6\frac{1}{2} \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 947 \quad 4 \quad 6\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (8) \quad 6 \quad \frac{1}{2} \quad 7514 \\
 \quad \quad \quad 4 \\
 \quad \quad \quad \hline
 \quad \quad \quad 30056 \\
 \quad \quad \quad 3757 \\
 \quad \quad \quad 626 \quad 2 \\
 2|0 \quad \hline
 \quad \quad 341|19 \quad 2 \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 1721 \quad 19 \quad 2}}
 \end{array}$$

$$\begin{array}{r}
 (12) \quad 4 \quad \frac{1}{3} \quad 2103 \\
 \quad \quad \quad 15 \\
 \quad \quad \quad \hline
 \quad \quad \quad 31545 \\
 \quad \quad \quad 701 \\
 \quad \quad \quad 87 \quad 7\frac{1}{2} \\
 2|0 \quad \hline
 \quad \quad 3233|3 \quad 7\frac{1}{2} \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 1616 \quad 13 \quad 7\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (9) \quad 3 \quad \frac{1}{4} \quad 2517 \\
 \quad \quad \quad 5 \\
 \quad \quad \quad \hline
 \quad \quad \quad 12585 \\
 \quad \quad \quad 629 \quad 3 \\
 2|0 \quad \hline
 \quad \quad \pounds. 1321|4 \quad 3 \\
 \quad \quad \hline
 \quad \quad \underline{\underline{660 \quad 14 \quad 3}}
 \end{array}$$

$$\begin{array}{r}
 (13) \quad 6 \quad \frac{1}{2} \quad 7152 \\
 \quad \quad \quad 17 \\
 \quad \quad \quad \hline
 \quad \quad \quad 121584 \\
 \quad \quad \quad 3576 \\
 \quad \quad \quad 298 \\
 \quad \quad \quad 349 \\
 2|0 \quad \hline
 \quad \quad 12560|7 \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 6280 \quad 7}}
 \end{array}$$

$$\begin{array}{r}
 (10) \quad 3 \quad \frac{1}{4} \quad 2547 \\
 \quad \quad \quad 7 \\
 \quad \quad \quad \hline
 \quad \quad \quad 17829 \\
 \quad \quad \quad 636 \quad 9 \\
 \quad \quad \quad 106 \quad 1\frac{1}{2} \\
 2|0 \quad \hline
 \quad \quad 1857|1 \quad 10\frac{1}{2} \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 928 \quad 11 \quad 10\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (14) \quad 6 \quad \frac{1}{2} \quad 2510 \\
 \quad \quad \quad 14 \\
 \quad \quad \quad \hline
 \quad \quad \quad 35140 \\
 \quad \quad \quad 1255 \\
 \quad \quad \quad 209 \quad 2 \\
 \quad \quad \quad 52 \quad 3\frac{1}{2} \\
 2|0 \quad \hline
 \quad \quad 3665|6 \quad 5\frac{1}{2} \\
 \quad \quad \hline
 \quad \quad \underline{\underline{\pounds. 1832 \quad 16 \quad 5\frac{1}{2}}}
 \end{array}$$

$$\begin{array}{r}
 (15) \quad 4 \overline{) 3715} \quad \frac{1}{3} \\
 \underline{9} \\
 33435 \\
 \underline{1238} \quad 4 \\
 154 \quad 9\frac{1}{2} \\
 \underline{2 \overline{) 0}} \quad 3482 \overline{) 8} \quad 1\frac{1}{2} \\
 \underline{\pounds. 17+1} \quad 8 \quad 1\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (16) \quad 6 \overline{) 2572} \quad \frac{1}{2} \\
 \underline{13} \\
 33436 \\
 \underline{1286} \\
 214 \quad 4 \\
 \underline{107} \quad 2 \\
 \underline{2 \overline{) 0}} \quad 3504 \overline{) 3} \quad 6 \\
 \underline{\pounds. 1752} \quad 3 \quad 6
 \end{array}$$

$$\begin{array}{r}
 (17) \quad 6 \overline{) 7251} \quad \frac{1}{2} \\
 \underline{11} \\
 101514 \\
 \underline{3625} \quad 6 \\
 1208 \quad 6 \\
 \underline{151} \quad 0\frac{3}{4} \\
 \underline{2 \overline{) 0}} \quad 10649 \overline{) 9} \quad 0\frac{3}{4} \\
 \underline{\pounds. 5324} \quad 19 \quad 0\frac{3}{4}
 \end{array}$$

$$\begin{array}{r}
 (18) \quad 6 \overline{) 3210} \quad \frac{1}{2} \\
 \underline{15} \\
 48150 \\
 \underline{1605} \\
 267 \quad 6 \\
 \underline{133} \quad 9 \\
 66 \quad 10\frac{1}{2} \\
 \underline{2 \overline{) 0}} \quad 5022 \overline{) 3} \quad 1\frac{1}{2} \\
 \underline{\pounds. 2511} \quad 3 \quad 1\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 (19) \quad 2 \overline{) 2710} \quad \frac{1}{6} \\
 \underline{19} \\
 51490 \\
 \underline{451} \quad 8 \\
 112 \quad 11 \\
 \underline{2 \overline{) 0}} \quad 5205 \overline{) 4} \quad 7 \\
 \underline{\pounds. 2602} \quad 14 \quad 7
 \end{array}$$

CASE VII.

$$\begin{array}{r}
 (1) \quad s. \quad 4 \overline{) 7215} \quad \frac{1}{3} \\
 \underline{7} \\
 50505 \\
 \underline{1443} \\
 \underline{\pounds. 51948}
 \end{array}$$

$$\begin{array}{r}
 (2) \quad s. d. \quad 2 \overline{) 6} \quad \frac{1}{8} \\
 \underline{5} \\
 10520 \\
 \underline{263} \\
 52 \quad 12 \\
 \underline{\pounds. 10835} \quad 12
 \end{array}$$

$s.$ $(1) 4 \frac{1}{5}$ 4 do.	2107 $\underline{2}$ 4214 $421 \quad 8$ $421 \quad 8$ $\underline{\underline{\pounds. 5056 \quad 16}}$	$s. d.$ $(8) 6 \quad 8 \quad \frac{1}{3}$	3215 $\underline{4}$ 12860 $1071 \quad 13 \quad 4$ $\underline{\underline{\pounds. 13931 \quad 13 \quad 4}}$
$(4) 5 \frac{1}{4}$ $1 \frac{1}{5}$ $d.$	7156 $\underline{5}$ 35780 1789 $357 \quad 16$ $\underline{\underline{\pounds. 37926 \quad 16}}$	$(9) 1 \frac{1}{20}$ $d.$ $3 \frac{1}{4}$	2154 $\underline{7}$ 15078 $107 \quad 14$ $26 \quad 18 \quad 6$ $\underline{\underline{\pounds. 15212 \quad 12 \quad 6}}$
$(3) 6 \frac{1}{2}$ $d.$ $1 \frac{1}{2} \frac{1}{4}$ $2 0$	2710 $\underline{43}$ 116530 1355 $338 \quad 9$ $11822 3 \quad 9$ $\underline{\underline{\pounds. 5911 \quad 3 \quad 9}}$	$s. d.$ $(10) 3 \quad 4 \quad \frac{1}{6}$	2701 $\underline{2}$ 5402 $450 \quad 3 \quad 4$ $\underline{\underline{\pounds. 5852 \quad 3 \quad 4}}$
$(6) 10 \frac{1}{2}$ $5 \frac{1}{2}$ $1 \frac{1}{5}$ 1 do.	3125 $1562 \quad 10$ $781 \quad 5$ $156 \quad 5$ $156 \quad 5$ $\underline{\underline{\pounds. 5781 \quad 5}}$	$(11) 10 \frac{1}{2}$ $5 \frac{1}{2}$ $2 \frac{1}{5}$ $2d \frac{1}{5}$ $\frac{1}{2} \frac{1}{4}$	2715 $1357 \quad 10$ $678 \quad 15$ $271 \quad 10$ $22 \quad 12 \quad 6$ $5 \quad 13 \quad 1\frac{1}{2}$ $\underline{\underline{\pounds. 5051 \quad 0 \quad 7\frac{1}{2}}}$
$(7) 10 \frac{1}{2}$ $2 \frac{1}{3}$ $1 \frac{1}{2}$	2107 $1053 \quad 10$ $210 \quad 14$ $105 \quad 7$ $\underline{\underline{\pounds. 3476 \quad 11}}$	$(12) 10 \frac{1}{2}$ $5 \frac{1}{2}$ $2d \frac{1}{30}$ $\frac{1}{4} \frac{1}{8}$	2517 $\underline{3}$ 7551 $1258 \quad 10$ $629 \quad 5$ $20 \quad 19 \quad 6$ $2 \quad 12 \quad 5\frac{1}{4}$ $\underline{\underline{\pounds. 9462 \quad 6 \quad 11\frac{1}{4}}}$

(13)	10	$\frac{1}{2}$	3210	
	5	$\frac{1}{2}$	1605	
	2	$\frac{1}{2}$	802	10
	1	$\frac{1}{2}$	321	0
	6	$\frac{1}{2}$	160	10
	$\frac{1}{2}$	$\frac{1}{2}$	80	5
	$\frac{1}{4}$	$\frac{1}{2}$	6	13 9
			3	6 $10\frac{1}{2}$
			<u>£.6189</u>	<u>5 $7\frac{1}{2}$</u>

(14)	4	$\frac{1}{5}$	2157	
			2	
			<u>4314</u>	
	2	$\frac{1}{2}$	431	8
	1	$\frac{1}{2}$	215	14
	4	$\frac{1}{2}$	107	17
	$\frac{1}{2}$	$\frac{1}{8}$	35	19
			4	9 $10\frac{1}{2}$
			<u>£.5109</u>	<u>7 $10\frac{1}{2}$</u>

(15)	10	$\frac{1}{2}$	142	
	5	$\frac{1}{2}$	71	
	2	$\frac{1}{2}$	35	10
	2	$\frac{1}{4}$	1	3 8
	1	$\frac{1}{4}$	0	5 11
	1	$\frac{1}{2}$	0	2 $11\frac{1}{2}$
			<u>£.250</u>	<u>2 $6\frac{1}{2}$</u>

(16)	10	$\frac{1}{2}$	95	
			15	
			<u>1425</u>	
	2	$\frac{1}{3}$	47	10
	2	$\frac{1}{4}$	9	10
	6	$\frac{1}{4}$	9	10
	1	$\frac{1}{8}$	2	7 6
	$\frac{1}{4}$	$\frac{1}{4}$	0	7 11
			0	1 $11\frac{3}{4}$
			<u>£.1494</u>	<u>7 $4\frac{3}{4}$</u>

(17)	10	$\frac{1}{2}$	37	
	5	$\frac{1}{2}$	18	10
	2	$\frac{1}{2}$	9	5
	4	$\frac{1}{2}$	3	14
	1	$\frac{1}{2}$	0	12 4
	$\frac{1}{2}$	$\frac{1}{2}$	0	3 1
	$\frac{1}{4}$	$\frac{1}{2}$	0	1 $6\frac{1}{2}$
			0	0 $9\frac{1}{4}$
			<u>£.69</u>	<u>6 $8\frac{1}{4}$</u>

(18)	10	$\frac{1}{2}$	2175	
			2	
			<u>4350</u>	
	5	$\frac{1}{2}$	1087	10
	4	$\frac{1}{2}$	543	15
	$\frac{1}{2}$	$\frac{1}{8}$	36	5
			4	10 $7\frac{1}{2}$
			<u>£.6022</u>	<u>0 $7\frac{1}{2}$</u>

(19)	10	$\frac{1}{2}$	2150	
			17	
			<u>30550</u>	
	5	$\frac{1}{2}$	1075	
	1	$\frac{1}{3}$	537	10
	1	$\frac{1}{5}$	107	10
	$\frac{1}{2}$	$\frac{1}{2}$	8	19 2
			4	97
			<u>£.38283</u>	<u>89</u>

Practice.

85

CASE VIII.

(1) $\begin{array}{l} \text{grs.} \\ 2 \frac{1}{2} \end{array}$ $\begin{array}{l} \text{£. s. d.} \\ 3 \ 17 \ 6 \end{array}$

$$\begin{array}{r} 5 \times 5 = 25. \\ 19 \ 7 \ 6 \\ \hline 5 \\ 96 \ 17 \ 6 \\ \hline 1 \ 18 \ 9 \\ 0 \ 9 \ 8 \frac{1}{4} \\ \hline \text{£. } 99 \ 5 \ 11 \frac{1}{4} \end{array}$$

(2) $\begin{array}{l} \text{grs.} \\ 1 \frac{1}{4} \end{array}$ $\begin{array}{l} \text{£. s. d.} \\ 1 \ 4 \ 9 \end{array}$

$$\begin{array}{r} 4 \times 4 + 1 = 17. \\ 4 \ 19 \ 0 \\ \hline 4 \\ 19 \ 16 \ 0 \\ \hline 1 \ 4 \ 9 \\ 0 \ 6 \ 2 \frac{1}{4} \\ 0 \ 3 \ 1 \\ 0 \ 0 \ 5 \frac{1}{4} \\ 0 \ 0 \ 2 \frac{1}{2} \\ \hline \text{£. } 21 \ 10 \ 8 \end{array}$$

(3) $\begin{array}{l} \text{grs.} \\ 1 \frac{1}{4} \end{array}$ $\begin{array}{l} \text{£. s. d.} \\ 1 \ 7 \ 8 \end{array}$

$$\begin{array}{r} 12 \times 7 + 1 = 85. \\ 16 \ 12 \ 0 \\ \hline 7 \\ 116 \ 4 \ 0 \\ \hline 1 \ 7 \ 8 \\ 0 \ 6 \ 11 \\ 0 \ 0 \ 11 \frac{3}{4} \\ 0 \ 0 \ 11 \frac{3}{4} \\ 0 \ 0 \ 5 \frac{3}{4} \\ \hline \text{£. } 118 \ 1 \ 0 \frac{1}{4} + \end{array}$$

H

Practice.

(4)	gr.	1	$\frac{1}{4}$	£	s.	d.	
				4	5	8	
							$12 \times 6 = 72.$
				51	8	0	
						6	
				308	8	0	
14 lb.		$\frac{1}{2}$		1	1	5	
2		$\frac{1}{7}$		0	10	$8\frac{1}{2}$	
2	do.			0	1	$6\frac{1}{2}$	
				0	1	$6\frac{1}{4}$	
				£.310	3	2	
(5)	grs	2	$\frac{1}{2}$	£.	s.	d.	
				1	1	4	
							$3 \times 9 = 27.$
				3	4	0	
						9	
				28	16	0	
14 lb.		$\frac{1}{4}$		0	10	8	
1		$\frac{1}{14}$		0	2	8	
				0	0	$2\frac{1}{2}$	
				£.29	9	$6\frac{1}{2}$	
(6)	grs.	2	$\frac{1}{2}$	£.	s.	d.	
				2	17	9	
							$11 \times 7 + 1 = 78.$
				31	15	3	
						7	
				222	6	9	
				2	17	9	
1		$\frac{1}{2}$		1	8	$10\frac{1}{2}$	
4 lb.		$\frac{1}{7}$		0	14	$5\frac{1}{4}$	
4	do.			0	2	$0\frac{3}{4}$	
4	do.			0	2	$0\frac{3}{4}$	
				0	2	$0\frac{3}{4}$	
				£.227	14	0	

Practice.

87

(7) *grs.* 1 $\frac{1}{4}$

<i>£.</i>	<i>s.</i>	<i>d.</i>
2	15	9
		$8 \times 7 = 56.$
22	6	0
		7

14 *lb* $\frac{1}{2}$

<i>£.</i>	<i>s.</i>	<i>d.</i>
156	2	0
0	13	$11\frac{1}{4}$
0	6	$11\frac{1}{2}$
0	0	$11\frac{3}{4}$
0	0	$5\frac{1}{2}$
<u>£</u>	<u>157</u>	<u>4 $\frac{1}{4}$</u>

(8) *lb.* 14 $\frac{1}{8}$

<i>£.</i>	<i>s.</i>	<i>d.</i>
3	17	10
		$12 \times 8 + 1 = 97.$
46	14	0
		8
373	12	0
3	17	10
0	9	$8\frac{3}{4}$
0	0	$8\frac{1}{4}$
<u>£</u>	<u>378</u>	<u>0 $\frac{3}{4}$</u>

(9) *grs.* 2 $\frac{1}{2}$

<i>£.</i>	<i>s.</i>	<i>d.</i>
4	14	6
		$6 \times 6 + 1 = 37.$
28	7	0
		6
170	2	0
4	14	6
2	7	3
0	6	9
0	3	$4\frac{1}{2}$
0	0	10
<u>£</u>	<u>177</u>	<u>14 $8\frac{1}{2}$</u>

H 2

(10) 1

Practice.

(10)		gr.		£.	s.	d.	
1	$\frac{1}{4}$			3	14	6	
							$5 \times 3 = 15.$
				18	12	6	
						3	
8 lb.	$\frac{1}{4}$	cwt.		55	17	6	
2	$\frac{1}{4}$			0	18	$7\frac{1}{2}$	
				0	5	$3\frac{3}{4}$	
				0	1	$3\frac{3}{4}$	
				£. 57	2	9	
(11)		grs.		£.	s.	d.	
2	$\frac{1}{2}$			4	15	4	
							$4 \times 4 \times 10 + 12 = 172.$
				19	1	4	
						4	
				76	5	4	
						10	
				762	13	4	
				57	4	0	$= 12 \text{ cwt.}$
1	$\frac{1}{2}$			2	7	8	
8 lb.	$\frac{1}{7}$ of 2	gr.		1	3	10	
4	$\frac{1}{2}$			0	6	$9\frac{1}{2}$	
				0	3	$4\frac{3}{4}$	
				£. 823	19	$0\frac{1}{4}$	
(12)		lb.		£.	s.	d.	
14	$\frac{1}{8}$			3	11	6	
							$10 \times 5 + 3 = 53.$
				35	15	0	
						5	
				78	15	0	
				10	14	6	$= 3 \text{ cwt.}$
2	$\frac{1}{7}$			0	8	$11\frac{1}{4}$	
1	$\frac{1}{2}$			0	1	$3\frac{1}{4}$	
				0	0	$7\frac{1}{2}$	
				£. 190	0	4	

SIMPLE

INTEREST.

SIMPLE INTEREST.

$$\begin{array}{r}
 \text{£.} \\
 (1) \quad 375 \\
 \underline{5} \\
 18 \overline{) 75} \\
 \underline{20} \text{ Ans. } 18\text{ l. } 15\text{ s.} \\
 \underline{15 \overline{) 00}}
 \end{array}$$

Or, the same done thus.

$$\begin{array}{r}
 \text{£.} \\
 2 \overline{) 0} 37 \overline{) 5} \\
 \underline{\text{£. } 18 \quad 15} \text{ as before}
 \end{array}$$

NOTE. When the interest is any aliquot part of an hundred, the question may be more expeditiously done by taking such aliquot part as is evident from the above.

$$\begin{array}{r}
 \text{£.} \\
 (2) \quad 25 \overline{) 268} \\
 \underline{\text{£. } 10 \quad 14} \quad 4\frac{3}{4} - \frac{1}{5} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \\
 (3) \quad 25 \left\{ \begin{array}{l} 5 \overline{) 945} \quad 10 \\ 5 \overline{) 189} \quad 2 \end{array} \right. \\
 \underline{\text{£. } 37 \quad 16} \quad 4\frac{3}{4} - \frac{1}{5} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 (4) \quad 547 \quad 15 \\
 \underline{3} \\
 16 \overline{) 43} \quad 5 \\
 \underline{20} \\
 8 \overline{) 65} \\
 \underline{12} \\
 7 \overline{) 80} \\
 \underline{4} \\
 3 \overline{) 20}
 \end{array}$$

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 \text{then } 16 \quad 8 \quad 7\frac{3}{4} - \frac{1}{5} \\
 \underline{3} \\
 \text{Ans. } 49 \quad 5 \quad 11\frac{1}{4} - \frac{3}{5}
 \end{array}$$

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 (5) \quad 25 \left\{ \begin{array}{l} 5 \overline{) 254} \quad 17 \quad 6 \\ 5 \overline{) 50} \quad 19 \quad 6 \end{array} \right. \\
 \underline{10 \quad 3 \quad 10\frac{3}{4} - \frac{1}{5} \text{ 1 y. in.}} \\
 \underline{5} \\
 \underline{50 \quad 19 \quad 6} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{£.} \quad \text{s.} \quad \text{d.} \\
 (6) \quad 2\frac{1}{2} \overline{) 556} \quad 13 \quad 4 \\
 \underline{27 \quad 16 \quad 8} \quad 1\text{-yr. in.} \\
 \underline{5} \\
 \underline{139 \quad 3 \quad 4} \text{ Ans.}
 \end{array}$$

COMMISSION.

$$\begin{array}{r}
 \text{(7)} \quad \begin{array}{r} \text{£. s.} \\ 287 \quad 10 \\ \hline \quad \quad 3\frac{1}{2} \\ 862 \quad 10 = 3 \\ 143 \quad 15 = \frac{1}{2} \\ \hline 10|06 \quad 5 \text{ sum.} \\ \hline \quad 20 \\ 1|25 \\ \hline \quad 12 \\ \hline 3|00 \\ \hline \hline \end{array}
 \end{array}$$

Ans. 10*l.* 1*s.* 3*d.*

$$\begin{array}{r}
 \text{(8)} \quad \begin{array}{r} \text{£. s. d.} \\ 529 \quad 18 \quad 5 \\ \hline \quad \quad \quad 2\frac{1}{4} \\ 1059 \quad 16 \quad 10 = 2 \\ 132 \quad 9 \quad 7\frac{1}{4} = \frac{1}{4} \\ \hline 11|92 \quad 6 \quad 5\frac{1}{4} \text{ sum.} \\ \hline \quad 20 \\ 18|46 \\ \hline \quad 12 \\ \hline 5|57 \\ \hline \quad 4 \\ \hline 2|29 \\ \hline \hline \end{array}
 \end{array}$$

Ans. 11*l.* 18*s.* 5½*d.*-29.

$$\begin{array}{r}
 \text{(9)} \quad \begin{array}{r} \text{£. s.} \\ 754 \quad 16 \\ \hline \quad \quad 2\frac{1}{2} \\ 1509 \quad 12 = 2 \\ 377 \quad 8 = \frac{1}{2} \\ \hline 18|87 \quad 0 \text{ sum.} \\ \hline \quad 20 \\ 17|40 \\ \hline \quad 12 \\ \hline 4|80 \\ \hline \quad 4 \\ \hline 3|20 \\ \hline \hline \end{array}
 \end{array}$$

Ans. 18*l.* 17*s.* 4¾*s.*

$$\begin{array}{r}
 \text{(10)} \quad \begin{array}{r} \text{£. s. d.} \\ \frac{1}{2} - \frac{1}{2} 876 \quad 5 \quad 10 \\ \hline \quad \quad \quad 3\frac{3}{4} \\ 2628 \quad 17 \quad 6 = 3 \\ \frac{1}{4} - \frac{1}{2} 438 \quad 2 \quad 11 = \frac{1}{2} \\ 219 \quad 1 \quad 5\frac{1}{2} = \frac{1}{4} \\ \hline 32|86 \quad 1 \quad 10\frac{1}{2} \text{ sum.} \\ \hline \quad 20 \\ 17|21 \\ \hline \quad 12 \\ \hline 2|62 \\ \hline \quad 4 \\ \hline 2|50 \\ \hline \hline \end{array}
 \end{array}$$

Ans. 32*l.* 17*s.* 2½*s.*

PUR.

PURCHASING OF STOCKS.

$$\begin{array}{r}
 \text{£. s.} \\
 (11) \quad 575 \quad 10 \\
 \quad \quad 6 \times 5 + 1 = 31 \\
 \hline
 3453 \quad 0 \\
 \quad \quad 5 \\
 \hline
 17265 \quad 0 = 30 \\
 \frac{1}{2} - \frac{1}{2} 575 \quad 10 = 1 \\
 \frac{1}{4} - \frac{1}{2} 287 \quad 15 = \frac{1}{2} \\
 \hline
 143 \quad 17 \quad 6 = \frac{1}{4} \\
 182 \overline{) 72} \quad 2 \quad 6 \text{ sum.} \\
 \hline
 20 \\
 14 \overline{) 42} \\
 \hline
 12 \\
 5 \overline{) 10} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 \text{Then to } 575 \quad 10 \quad 0 \\
 \text{add } 182 \quad 14 \quad 5 \\
 \hline
 \text{gives } 758 \quad 4 \quad 5 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{£. s.} \\
 (12) \quad 254 \quad 17 \\
 \quad \quad 12 \times 8 + 1 = 97 \\
 \hline
 3058 \quad 4 \\
 \quad \quad 8 \\
 \hline
 24465 \quad 12 \quad 0 = 96 \\
 254 \quad 17 \quad 0 = 1 \\
 63 \quad 14 \quad 3 = \frac{1}{4} \\
 \hline
 247 \overline{) 84} \quad 3 \quad 3 \text{ sum.} \\
 \hline
 20 \\
 16 \overline{) 83} \\
 \hline
 12 \\
 9 \overline{) 99} \\
 \hline
 4 \\
 3 \overline{) 96} \\
 \hline
 \hline
 \end{array}$$

Ans. 247*l.* 16*s.* 9 $\frac{3}{4}$ *d.* 96.

$$\begin{array}{r}
 \text{£. s.} \\
 (13) \quad 2054 \quad 16 \\
 \quad \quad 10 \frac{1}{4} \\
 \hline
 20548 \quad 0 = 10 \\
 513 \quad 14 = \frac{1}{4} \\
 \hline
 210 \overline{) 61} \quad 14 \text{ sum.} \\
 \hline
 20 \\
 12 \overline{) 34} \\
 \hline
 12 \\
 4 \overline{) 08} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 \text{Then to } 2054 \quad 16 \quad 0 \\
 \text{add } 210 \quad 12 \quad 4 \\
 \hline
 \text{gives } 2265 \quad 8 \quad 4 \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{£. s.} \\
 (14) \quad 1797 \quad 14 \\
 \quad \quad 4 \frac{3}{8} \\
 \hline
 7190 \quad 16 \quad 0 = 4 \\
 674 \quad 2 \quad 9 = \frac{3}{8} \\
 \hline
 78 \overline{) 64} \quad 18 \quad 9 \text{ sum.} \\
 \hline
 20 \\
 12 \overline{) 98} \\
 \hline
 12 \\
 11 \overline{) 85} \\
 \hline
 4 \\
 3 \overline{) 40} \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{£. s. d.} \\
 \text{Then to } 1797 \quad 14 \quad 0 \\
 \text{add } 78 \quad 12 \quad 11 \frac{3}{4} \\
 \hline
 \text{gives } 1876 \quad 6 \quad 11 \frac{3}{4} \text{ Ans.} \\
 \hline
 \hline
 \end{array}$$

(15) 2750.

$$\begin{array}{r}
 \text{(15)} \quad \begin{array}{c} \text{£. s.} \\ 2750 \quad 17 \\ \hline 2\frac{5}{8} \\ \hline 5501 \quad 14 \quad 0 = 2 \\ 1719 \quad 5 \quad 7\frac{1}{2} = \frac{3}{8} \\ \hline 72 \overline{) 20 \quad 19} \quad 7\frac{1}{2} \text{ sum.} \\ 20 \\ \hline 4 \overline{) 19} \\ 12 \\ \hline 2 \overline{) 35} \\ 4 \\ \hline 1 \overline{) 42} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{Then to } \begin{array}{c} \text{£. s. d.} \\ 2750 \quad 17 \quad 0 \\ \text{add } 72 \quad 4 \quad 2\frac{1}{4} \\ \hline \text{gives } 2823 \quad 1 \quad 2\frac{1}{4} \text{ Ans.} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(16)} \quad \begin{array}{c} \text{£. s.} \\ 577 \quad 19 \\ \hline 12 \times 8 = 96 \\ \hline 6935 \quad 8 \\ \hline 8 \\ \hline 55483 \quad 4 \quad 0 = 96 \\ 433 \quad 9 \quad 3 = \frac{3}{4} \\ \hline 559 \overline{) 16 \quad 13} \quad 3 \text{ sum.} \\ 20 \\ \hline 3 \overline{) 33} \\ 12 \\ \hline 3 \overline{) 99} \\ 4 \\ \hline 3 \overline{) 96} \end{array}
 \end{array}$$

Ans. 559l. 3s. $3\frac{3}{4}$ d. - 96.

$$\begin{array}{r}
 \text{(v)} \quad \begin{array}{c} \text{£. s. d.} \\ 758 \quad 17 \quad 10 \\ \hline 6 \times 4 = 24 \\ \hline 4553 \quad 7 \quad 0 \\ \hline 4 \\ \hline 18213 \quad 8 \quad 0 = 24 \\ 474 \quad 6 \quad 1\frac{3}{4} = \frac{3}{8} \\ \hline 186 \overline{) 87 \quad 14} \quad 1\frac{3}{4} \text{ sum.} \\ 20 \\ \hline 17 \overline{) 54} \\ 12 \\ \hline 6 \overline{) 49} \\ 4 \\ \hline 1 \overline{) 99} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{Then to } \begin{array}{c} \text{£. s. d.} \\ 758 \quad 17 \quad 10 \\ \text{add } 186 \quad 17 \quad 6\frac{1}{4} \cdot 99 \\ \hline \text{gives } 945 \quad 15 \quad 4\frac{1}{4} \cdot 99 \text{ Ans.} \end{array}
 \end{array}$$

BROKAGE.

(18) First $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 25 \overline{) 75} \quad 17 \quad 6 \\ \underline{20} \\ 15 \overline{) 17} \\ \underline{12} \\ 2 \overline{) 10} \end{array}$ then $4 - \frac{1}{2}$ $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 25 \quad 15 \quad 2 \\ \underline{5 \quad 3 \quad 0 \frac{1}{2}} \text{Ans.} \end{array}$

(19) First $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 7 \overline{) 96} \quad 14 \quad 7 \\ \underline{20} \\ 19 \overline{) 34} \\ \underline{12} \\ 4 \overline{) 15} \end{array}$ then $5 - \frac{1}{4}$ $\begin{array}{r} \text{s.} \quad \text{£.} \quad \text{s.} \quad \text{d.} \\ 5 - \frac{1}{4} \overline{) 7} \quad 19 \quad 4 \\ \underline{1 - \frac{1}{2}} \quad 1 \quad 19 \quad 10 \\ \underline{0 \quad 7 \quad 11 \frac{1}{2}} \\ 2 \quad 7 \quad 9 \frac{1}{2} \text{Ans.} \end{array}$

(20) First $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 71 \overline{) 05} \quad 5 \quad 10 \\ \underline{20} \\ 1 \overline{) 05} \\ \underline{12} \\ 0 \overline{) 70} \\ \underline{4} \\ 2 \overline{) 80} \end{array}$ then $5 - \frac{1}{4}$ $\begin{array}{r} \text{s.} \quad \text{£.} \quad \text{s.} \quad \text{d.} \\ 5 - \frac{1}{4} \overline{) 71} \quad 1 \quad 0 \frac{1}{2} \\ 6d. - \frac{1}{10} \overline{) 17} \quad 15 \quad 3 \\ \underline{1 \quad 15 \quad 6 \frac{1}{4}} \\ 19 \quad 10 \quad 9 \frac{1}{4} \text{Ans.} \end{array}$

(21) First $\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 9 \overline{) 75} \quad 6 \quad 4 \\ \underline{20} \\ 15 \overline{) 06} \\ \underline{12} \\ 0 \overline{) 76} \\ \underline{4} \\ 3 \overline{) 04} \end{array}$ then $5 - \frac{1}{4}$ $\begin{array}{r} \text{s.} \quad \text{£.} \quad \text{s.} \quad \text{d.} \\ 5 - \frac{1}{4} \overline{) 9} \quad 15 \quad 0 \frac{3}{4} \\ 1 - \frac{1}{2} \overline{) 2} \quad 8 \quad 9 \\ 6d. - \frac{1}{2} \overline{) 0} \quad 9 \quad 9 \\ \underline{0 \quad 4 \quad 10 \frac{1}{2}} \\ 3 \quad 3 \quad 4 \frac{1}{2} \text{Ans.} \end{array}$

(22) First

(22) First £. s. d. then $3\frac{1}{4}$ mo. £. s. d.

554	10	4
<hr/>		
22	18	0
<hr/>		
	20	
<hr/>		
3	60	
<hr/>		
	12	
<hr/>		
7	20	
<hr/>		

22	3	7
<hr/>		
5	10	10 $\frac{3}{4}$
<hr/>		

Ans.

(23) First £. s. d. then $2\frac{1}{2}$ £. s. d.

336	15	6
<hr/>		
16	18	5
<hr/>		
	20	
<hr/>		
16	77	
<hr/>		
	12	
<hr/>		
9	30	
<hr/>		
	4	
<hr/>		
1	20	
<hr/>		

16	16	9 $\frac{1}{4}$
<hr/>		
33	13	6 $\frac{1}{2}$
<hr/>		
8	8	4 $\frac{1}{2}$
<hr/>		
4	4	2 $\frac{1}{4}$
<hr/>		
46	6	1 $\frac{1}{4}$
<hr/>		

Ans.

(24) First £. s. d. then $1\frac{1}{2}$ £. s. d.

325	7	6
<hr/>		
19	52	5
<hr/>		
	20	
<hr/>		
10	45	
<hr/>		
	12	
<hr/>		
5	40	
<hr/>		
	4	
<hr/>		
1	60	
<hr/>		

19	10	5 $\frac{1}{4}$
<hr/>		
58	11	3 $\frac{1}{2}$
<hr/>		
9	15	2 $\frac{1}{2}$
<hr/>		
68	6	6 $\frac{1}{4}$
<hr/>		

Ans.

(25) First

Ans.

	£.	s.	d.		£.	s.	d.
(25) First	547	2	4	then $\frac{1}{2}-\frac{1}{2}$	21	17	$8\frac{1}{4}$
			4				5
	21	88	9 4		109	8	$5\frac{1}{4}$
	20				10	18	10
	17	69			120	7	$3\frac{1}{2}$ <i>Ans.</i>
	12						
	8	32					
	4						
	1	28					

	£.	s.	d.		£.	s.	d.
(26) First	257	5	1	then $\frac{1}{2}-\frac{1}{2}$	10	5	$9\frac{1}{2}$
			4	$\frac{1}{4}-\frac{1}{2}$	5	2	$10\frac{3}{4}$
	10	29	0 4		2	11	$5\frac{1}{4}$
	20				18	0	$1\frac{1}{2}$ <i>Ans.</i>
	5	80					
	12						
	9	64					
	4						
	2	56					

	£.	s.			£.	s.	d.
(27) First	479	5		then $\frac{1}{4}-\frac{1}{4}$	23	19	3
		5					5
	23	96	5		119	16	3
	20				5	19	$9\frac{3}{4}$
	19	25			125	16	$0\frac{3}{4}$ <i>Ans.</i>
	12						
	3	00					

(23) First

(28) First $\frac{1}{2}-\frac{1}{2}$ 175 17 0 then $\frac{1}{4}-\frac{1}{4}$ 7 18 3

£. s. d.	£. s. d.
4	2
703 8 0	15 16 6
87 18 6	$\frac{1}{4}-\frac{1}{4}$ 3 19 $1\frac{1}{2}$
7 91 6 6 Sum.	1 19 $6\frac{3}{4}$
20	21 15 $2\frac{1}{4}$ Ans.
18 26	
12	
3 18	

(29) First £. s. d. then $\frac{1}{4}-\frac{1}{4}$ £. s. d.

£. s. d.	£. s. d.
397 9 5	13 18 $2\frac{3}{4}$
$3\frac{1}{2}$	2
1192 8 3	27 16 $5\frac{1}{2}$
198 14 $8\frac{1}{2}$	3 9 $6\frac{1}{2}$
13 91 2 $11\frac{1}{2}$ Sum.	31 6 0 Ans.
20	
18 22	
12	
2 75	
4	
3 02	

(30) First £. s. d. then £. s. d.

£. s. d.	£. s. d.
576 2 7	25 18 6
$4\frac{1}{2}$	$7\frac{1}{4}$
2304 10 4	181 9 6
288 1 $3\frac{1}{2}$	6 9 $7\frac{1}{2}$
25 92 11 $7\frac{1}{2}$ Sum.	187 19 $1\frac{1}{2}$ Ans.
20	
18 51	
12	
6 19	
3	

	£.	s.	d.		£.	s.	d.
(31) First	279	13	8	then	14	13	8
			$5\frac{1}{4}$				$3\frac{1}{2}$
	1398	8	4		44	1	0
	69	18	5		7	6	10
	14 68	6	9		51	7	10
	20						<i>Ans.</i>
	13 66						
	12						
	8 01						

To find the interest for any number of weeks.

(31) First $\frac{379\text{ l. } 13\text{ s. } 2\text{ d.} \times 4}{100} = 15\text{ l. } 3\text{ s. } 8\frac{1}{2}\text{ d.} = 88$, the interest of the given sum for a year, and as 4 weeks are the $\frac{1}{13}$ of 52, therefore $13) 15\text{ l. } 3\text{ s. } 8\frac{1}{2}\text{ d.} (= 1\text{ l. } 3\text{ s. } 4\frac{1}{2}\text{ d.})$ the answer required.

(31) As $100\text{ l.} : 259\text{ l. } 13\text{ s. } 5\text{ d.} :: 5\text{ l.} : (\text{first answer})$, and as $52\text{ w.} : 20\text{ w.} :: \text{first answer} : (\text{answer required})$, then $\frac{259\text{ l. } 13\text{ s. } 5\text{ d.} \times 5 \times 20}{100 \times 52} = \frac{259\text{ l. } 13\text{ s. } 5\text{ d.}}{52} = 4\text{ l. } 19\text{ s. } 10\frac{1}{4}\text{ d.}$ answer required.

(34) As $100\text{ l.} : 375\text{ l. } 6\text{ s. } 1\text{ d.} :: 4\frac{1}{2}\text{ l.} : (\text{first answer})$, and as $52\text{ w.} : 12\text{ w.} :: \text{first answer} : (\text{to the second answer})$, then $\frac{375\text{ l. } 6\text{ s. } 1\text{ d.} \times 4\frac{1}{2} \times 12}{100 \times 52} = 3\text{ l. } 17\text{ s. } 11\frac{1}{4}\text{ d.}$ the interest, and $375\text{ l. } 6\text{ s. } 1\text{ d.} + 3\text{ l. } 17\text{ s. } 11\frac{1}{4}\text{ d.} = 379\text{ l. } 4\text{ s. } 0\frac{1}{4}\text{ d.}$ the amount required.

(35) As $100 : 256 \text{ l. } 5 \text{ s. } 3 \text{ d.} :: 2\frac{3}{4} : (\text{1st. Ans.})$

And as $52 : 25 :: 1\text{st. Ans.} : (\text{to the 2d Ans.})$

Then $\frac{256 \text{ l. } 5 \text{ s. } 3 \times 2\frac{3}{4} \times 25}{100 \times 52} = 3\text{ l. } 7\text{ s. } 9\text{ d.}$ the interest, and

$256 \text{ l. } 5 \text{ s. } 3 + 3 \text{ l. } 7 \text{ s. } 9 = 259 \text{ l. } 13 \text{ s. } 12 \text{ d.}$ the amount req.

To

To find the interest for any number of days.

$$(36) \text{ As } \begin{array}{ccc} l. & l. & l. \\ 100 & : & 240 & : & 4 & : \end{array} \text{ (1st Ans.)}$$

$$\text{And as } \begin{array}{ccc} da. & da. & \\ 365 & : & 120 & : & 1 \end{array} \text{ (Ans. req.)}$$

$$\text{Then } \frac{240 \times 4 \times 120}{100 \times 365} = 3l. 3s. 1\frac{1}{4}d. = 335 \text{ Ans. req.}$$

$$(37) \text{ First } \begin{array}{ccc} \text{£.} & \text{s.} & \text{d.} \\ 210 & 379 & 5 & 4 \end{array}$$

18 19 3 the interest for a year.

$$\begin{array}{ccc} & 3 & \\ 56 & 17 & 9 \end{array} \text{ ditto, for 3 years.}$$

$$\begin{array}{ccccccc} da. & l. & s. & d. & da. & l. & s. & d. \end{array}$$

$$\text{Again as } 365 : 18 \ 19 \ 3 :: 75, \text{ then } \frac{18 \ 19 \ 3 \times 75}{365} = 3l. 17s. 11d. \text{ whence } 56l. 17s. 9d. + 3l. 17s. 11d. = 60l. 15s. 8d. \text{ Ans.}$$

$$(38) \text{ First } \frac{985l. 2s. 7d. \times 5\frac{1}{2}}{100} = 54l. 3s. 7\frac{1}{2}d. \text{ 82 the interest for a year, which } \times \text{ed by 5 gives } 270l. 18s. 2\frac{1}{2}d. \text{ the interest for 5 years, then as } 365da. : 54l. 3s. 7\frac{1}{2}d. :: 127da. : \frac{54l. 3s. 7\frac{1}{2}d. \times 127}{365} = 18l. 17s. 0\frac{1}{2}d. \text{ and } 270l. 18s. 2\frac{1}{2}d. + 18l. 17s. 0\frac{1}{2}d. = 289l. 15s. 3d. \text{ the Ans. req.}$$

$$(39) \text{ First } \frac{2726l. 1s. 4d. \times 4\frac{1}{2}}{100} = 122l. 13s. 5\frac{1}{2}d. \text{ which } \times \text{ed by 3, gives } 368l. 0s. 4\frac{1}{2}d. \text{ the interest for 3 years, then as } 365da. : 122l. 13s. 5\frac{1}{2}d. :: 154da. : \frac{122l. 13s. 5\frac{1}{2}d. \times 154}{365} = 51l. 15s. 1\frac{3}{4}d. \text{ and } 368l. 0s. 4\frac{1}{2}d. + 51l. 15s. 1\frac{3}{4}d. = 419l. 15s. 6\frac{1}{4}d. \text{ the Ans. req.}$$

(40) First

How to find the principal, by having the amount, time, and rate per cent. given.

(40) First, $3 \times 5 + 100 = 115$ l. amount of 100 l. for the given time; then as 115 l. : 100 l. :: 402 l. 10 s. : $\frac{402 \text{ l. } 10 \text{ s.} \times 100}{115} = 350 \text{ l.}$ Ans.

(41) First, $4 \times 9 + 100 = 136$ l. the amount of 100 l. for the given time, then as 136 l. : 100 l. :: 734 l. 8 s. : $\frac{734 \text{ l. } 8 \text{ s.} \times 100}{136} = 540 \text{ l.}$ the Ans.

(42) First, $5 \times 7 + 100 = 135$ l. the amount of 100 l. for the given time, then as 135 l. : 100 l. :: 334 l. 16 s. : $\frac{334 \text{ l. } 16 \text{ s.} \times 100}{135} = 248$ the Ans.

How to find the time, by having the principal, rate per cent. and amount given.

(43) First, as 100 l. : 3 l. :: 350 l. : 10 l. 10 s. interest of the principal for one year, then as 10 l. 10 s. : 1 yr. : 52 l. 10 s. : 5 years the Ans.

(44) First, as 100 l. : 4 l. :: 540 l. : 21 l. 12 s. interest of the principal for one year, then as 21 l. 12 s. : 1 yr. : 194 l. 8 s. : 9 years the Ans.

(45) First, $2 \text{ l. } 0 \text{ s. } 24 \text{ s. } 8 \text{ s.}$ interest of the principal for one year.
then, as 12 l. 8 s. : 1 yr. :: 86 l. 16 s. : 7 years the Ans.

How to find the rate per cent, by having the principal, amount, and time given.

(46) First, as 402 l. 10 s. - 350 l. = 52 l. 10 s. interest for the whole time, then as 350 l. : 52 l. 10 s. :: 100 : $\frac{52 \text{ l. } 10 \text{ s.} \times 100}{350} = 15$ l. whence $15 \div 5 = 3$ the rate per cent.

(47) First, 334 l. 16 s. - 248 l. = 86 l. 16 s. the interest for the whole time, then as 248 l. : 86 l. 16 s. :: 100 l. : $\frac{86 \text{ l. } 16 \text{ s.} \times 100}{248} = 35$ l. whence $35 \div 7 = 5$ the rate per cent.

(48) First, $734\text{ l. } 8\text{ s.} - 540\text{ l.} = 194\text{ l. } 8\text{ s.}$ the interest for the whole time, then as $540\text{ l.} : 194\text{ l. } 8\text{ s.} :: 100 : 194\text{ l. } 8\text{ s.} \times 100 = 36\text{ l.}$ whence $36 \div 9 = 4$ the rate per cent.

COMPOUND INTEREST.

(1) $\begin{array}{r} \text{£.} \\ \frac{1}{20}) 500 \\ \underline{25} \\ \frac{1}{20}) 525 \\ \underline{26} \quad 5 \\ \frac{1}{20}) 551 \quad 5 \\ \underline{27} \quad 11 \quad 3 \\ 578 \quad 16 \quad 3 \text{ amount.} \\ 500 \quad 0 \quad 0 \text{ the first year's principal.} \\ \text{Diff. } \underline{\underline{78 \quad 16 \quad 3}} \text{ the interest for 3 years.} \end{array}$

(2) First, $400\text{ l.} \times 6 = 2400\text{ l.}$ which $\div 100 = 24\text{ l.}$ interest, which added to $400\text{ l.} = 424\text{ l.}$ second year's principal, then $424\text{ l.} \times 6 = 2544\text{ l.}$ which $\div 100 = 25\text{ l. } 8\text{ s. } 9\frac{1}{2}\text{ d.}$ interest, which added to $424\text{ l.} = 449\text{ l. } 8\text{ s. } 9\frac{1}{2}\text{ d.}$ third year's principal, which \times by $6 = 2695\text{ l. } 12\text{ s. } 9\text{ d.}$ and \div by $100 = 26\text{ l. } 10\text{ s. } 3\frac{3}{4}\text{ d.}$ interest, which added to $449\text{ l. } 8\text{ s. } 9\frac{1}{2}\text{ d.} = 476\text{ l. } 8\text{ s. } 1\frac{1}{4}\text{ d.}$ fourth year's principal, which $\times 6 = 2858\text{ l. } 8\text{ s. } 7\frac{1}{2}\text{ d.}$ and $\div 100 = 28\text{ l. } 11\text{ s. } 8\text{ d.}$ half of which is $= 14\text{ l. } 5\text{ s. } 10\text{ d.}$ interest for half a year, then $476\text{ l. } 8\text{ s. } 1\frac{1}{4}\text{ d.} + 14\text{ l. } 5\text{ s. } 10\text{ d.} = 490\text{ l. } 13\text{ s. } 11\frac{1}{4}\text{ d.}$ the amount req.

(3) $\begin{array}{r} \text{£.} \\ \frac{1}{20}) 650 \\ \underline{32 \quad 10} \\ \frac{1}{20}) 682 \quad 10 \\ \underline{34 \quad 2 \quad 6} \\ \frac{1}{20}) 716 \quad 12 \quad 6 \\ \underline{35 \quad 16 \quad 7\frac{1}{2}} \\ \frac{1}{20}) 752 \quad 9 \quad 1\frac{1}{2} \\ \underline{37 \quad 12 \quad 5\frac{1}{4}} \\ \frac{1}{20}) 790 \quad 1 \quad 6\frac{3}{4} \\ \underline{39 \quad 10 \quad 0\frac{3}{4}} \\ \underline{\underline{829 \quad 11 \quad 7\frac{1}{2}}} \text{ the amount required.} \end{array}$

Interest.

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101

(4) First, $550\text{ l. } 10\text{ s.} \times 6 = 3303$ which $\div 100 = 33\text{ l. } 6\text{ s. } 7\text{ d.}$ interest, which added to $550\text{ l. } 10\text{ s.} = 583\text{ l. } 10\text{ s. } 7\text{ d.}$ second year's principal, then $583\text{ l. } 10\text{ s. } 7\text{ d.} \times 6 = 3501\text{ l. } 3\text{ s. } 6\text{ d.}$ which $\div 100 = 35\text{ l. } 0\text{ s. } 2\frac{1}{2}\text{ d.}$ interest, and added to $583\text{ l. } 10\text{ s. } 7\text{ d.} = 618\text{ l. } 10\text{ s. } 9\frac{1}{2}\text{ d.}$ third year's principal, which \times by $6 = 3711\text{ l. } 4\text{ s. } 10\frac{1}{2}\text{ d.}$ and $\div 100 = 37\text{ l. } 2\text{ s. } 2\frac{1}{2}\text{ d.}$ interest, which added to $618\text{ l. } 10\text{ s. } 9\frac{1}{2}\text{ d.} = 655\text{ l. } 13\text{ s. } 0\frac{1}{2}\text{ d.}$ fourth year's principal, which \times by 6 and $\div 100 = 39\text{ l. } 6\text{ s. } 9\frac{1}{2}\text{ d.}$ half of which is $19\text{ l. } 13\text{ s. } 4\frac{1}{2}\text{ d.}$ then $655\text{ l. } 13\text{ s. } 0\frac{1}{2}\text{ d.} + 19\text{ l. } 13\text{ s. } 4\frac{1}{2}\text{ d.} = 675\text{ l. } 6\text{ s. } 5\text{ d.}$ the amount required.

(5) First, $764\text{ l.} \times 6 = 4584\text{ l.}$ which $\div 100 = 45\text{ l. } 16\text{ s. } 9\frac{1}{2}\text{ d.}$ interest, which added to $764\text{ l.} = 809\text{ l. } 16\text{ s. } 9\frac{1}{2}\text{ d.}$ second year's principal; then $809\text{ l. } 16\text{ s. } 9\frac{1}{2}\text{ d.} \times$ by $6 = 4859\text{ l. } 0\text{ s. } 9\text{ d.}$ and $\div 100 = 48\text{ l. } 11\text{ s. } 9\frac{1}{2}\text{ d.}$ interest, which added to $809\text{ l. } 16\text{ s. } 9\frac{1}{2}\text{ d.} = 858\text{ l. } 8\text{ s. } 7\text{ d.}$ third year's principal, which \times by $6 = 5150\text{ l. } 11\text{ s. } 6\text{ d.}$ and $\div 100 = 51\text{ l. } 10\text{ s. } 1\frac{1}{2}\text{ d.}$ interest, which added to $858\text{ l. } 8\text{ s. } 7\text{ d.} = 909\text{ l. } 18\text{ s. } 8\frac{1}{4}\text{ d.}$ fourth year's principal, which \times by $6 = 5459\text{ l. } 12\text{ s. } 1\frac{1}{2}\text{ d.}$ and $\div 100 = 54\text{ l. } 11\text{ s. } 11\text{ d.}$ interest, which added to $909\text{ l. } 18\text{ s. } 8\frac{1}{4}\text{ d.} = 964\text{ l. } 10\text{ s. } 7\frac{1}{4}\text{ d.}$ fifth year's principal, which \times by $6 = 5787\text{ l. } 3\text{ s. } 7\frac{1}{2}\text{ d.}$ and $\div 100 = 57\text{ l. } 17\text{ s. } 5\text{ d.}$ three fourths of which is $43\text{ l. } 8\text{ s. } 0\frac{3}{4}\text{ d.}$ interest for 9 months, hence $964\text{ l. } 10\text{ s. } 7\frac{1}{4}\text{ d.} + 43\text{ l. } 8\text{ s. } 0\frac{3}{4}\text{ d.} = 1007\text{ l. } 18\text{ s. } 8\text{ d.}$ and $1007\text{ l. } 18\text{ s. } 8\text{ d.} - 764\text{ l.} = 243\text{ l. } 18\text{ s. } 8\text{ d.}$ the compound interest req.

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(6) $\frac{1}{2}$

(6)	£.	s.	d.	
	$\frac{1}{20}$)57	10	7	First year's principal.
		2	17	6 $\frac{1}{4}$ interest.
	$\frac{1}{20}$)60	8	0 $\frac{1}{4}$	Second year's principal.
		3	0	4 $\frac{3}{4}$ interest.
	$\frac{1}{20}$)63	8	5	Third year's principal.
		3	3	5 interest.
	$\frac{1}{20}$)66	11	10	Fourth year's principal.
		3	6	7 interest.
	$\frac{1}{20}$)69	18	5	Fifth year's principal.
		3	9	11 interest.
	$\frac{1}{20}$)73	8	4	Amount.
6 mo.	$\frac{1}{2}$)3	13	5	Sixth year's interest.
1	$\frac{1}{8}$)1	16	8 $\frac{1}{2}$	
14 days	$\frac{1}{2}$)0	6	1 $\frac{1}{4}$	
1	$\frac{1}{4}$)0	3	0 $\frac{1}{2}$	
		0	0	2 $\frac{1}{2}$
	Sum	2	6	0 $\frac{3}{4}$ Interest for 7 mo. 15 days.
	Add	73	8	4
	Sum	75	14	4 $\frac{3}{4}$ The whole amount.
		57	10	6 Deduct.
	£.	18	3	10 $\frac{3}{4}$ The compound interest required.

(7) First 259*l.* 10*s.* $\times 4\frac{1}{2} = 1167$ *l.* 15*s.* which $\div 100 = 11$ *l.* 13*s.* 6 $\frac{1}{2}$ *d.* interest, which added to 259*l.* 10*s.* = 271*l.* 3*s.* 6 $\frac{1}{2}$ *d.* second year's principal; then 271*l.* 3*s.* 6 $\frac{1}{2}$ *d.* \times by $4\frac{1}{2} = 1220$ *l.* 5*s.* 11 $\frac{1}{4}$ *d.* and $\div 100 = 12$ *l.* 4*s.* 0 $\frac{1}{2}$ *d.* interest, which added to 271*l.* 3*s.* 6 $\frac{1}{2}$ *d.* = 283 *l.* 7*s.* 7*d.* third year's principal; which \times by $4\frac{1}{2} = 1275$ *l.* 4*s.* 1 $\frac{1}{2}$ *d.* and $\div 100 = 12$ *l.* 15*s.* 0 $\frac{1}{4}$ *d.* interest, which added to 283 *l.* 7*s.* 7*d.* = 296 *l.* 2*s.* 7 $\frac{1}{2}$ *d.* fourth year's principal; which \times by $4\frac{1}{2}$ and $\div 100 = 13$ *l.* 6*s.* 6*d.* interest for the fourth year; then

6 mo,

Rebate on Discount.

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	£.	s.	d.	
6 mo.	13	6	6	
2	6	13	3	
1	2	4	5	
7 days	1	2	2½	
	0	5	6½	
3 days	0	2	4½	
Sum	10	7	9½	Interest for 9 months 10 days.
Add	296	2	7¼	
Sum	306	10	4½	= the amount.
Sub.	259	10	0	
	£. 47	0	4½	the compound interest required.

REBATE OR DISCOUNT.

(1) First 6 mo.	£. 6	then as	103 : 3 :: 487 12
Add	100		
Amount	103		
		2060	9752
		206	3
		2060	3925
		206	14 4 rebate.

From	£. 487 12
Take	14 4
Diff.	473 8 = Present worth.

206	865
824	416
20	20
832	0
824	
80 rem.	

(2) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 9 months) is readily found to be 103*l.* 15*s.* then by the rule 103*l.* 15*s.* : 100*l.* :: 357*l.* 10*s.* : 344*l.* 11*s.* 7*d.* the present worth required.

(3) The

(3) The amount of 100*l.* at the rate per cent. and for the given time (viz. 7 months) is 102*l.* 18*s.* 4*d.* then by the rule, 102*l.* 18*s.* 4*d.* : 2*l.* 18*s.* 4*d.* :: 275*l.* 10*s.* : 7*l.* 16*s.* 13*d.* the discount required.

(4) The amount of 100*l.* at the rate per cent. and for the given time (viz. 9 months) is 104*l.* 10*s.* then by the rule, 104*l.* 10*s.* : 100*l.* :: 109*l.* 10*s.* : 104*l.* 15*s.* 8½*d.* the present worth required.

(5) The amount of 100*l.* at the rate per cent. and for the given time (viz. 7 months) is 102*l.* 9*s.* 7*d.* then by the rule, 102*l.* 9*s.* 7*d.* : 100*l.* :: 527*l.* 9*s.* 1*d.* : 514*l.* 13*s.* 10½*d.* the present worth required.

(6) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 66 days) is 100*l.* 18*s.* 0¾*d.* then by the rule, 100*l.* 18*s.* 0¾*d.* : 18*s.* 0¾*d.* :: 85*l.* 10*s.* : 15*l.* 3½*d.* the discount required.

(7) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 5 months) is 101*l.* 16*s.* then by the rule, 101*l.* 16*s.* : 100*l.* :: 875*l.* 5*s.* 6*d.* : 859*l.* 15*s.* 11½*d.* the present worth required.

(8) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 10 months) is 104*l.* 3*s.* 4*d.* then by the rule, 104*l.* 3*s.* 4*d.* : 100*l.* :: 500*l.* : 480*l.* the present worth required.

(9) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 15 months) is 106*l.* 5*s.* then by the rule, 106*l.* 5*s.* : 100*l.* :: 75*l.* : 70*l.* 11*s.* 9*d.* the present worth required.

(10) The amount of 100*l.* at the given rate per cent for the time of the first payment, (viz. 4 months) is found to be 101*l.* 13*s.* 4*d.* then by the rule, 101*l.* 13*s.* 4*d.* : 100*l.* :: 50*l.* : 49*l.* 3*s.* 7¼*d.* present worth of the first payment.

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Again, for the second time of payment, (viz. 3 months) the amount of 100*l.* will be 103*l.* 6*s.* 8*d.* then 103*l.* 6*s.* 8*d.* : 100*l.* :: 50*l.* : 48*l.* 7*s.* 8½*d.* present worth of the second payment.

Once more, for the third time of payment, (viz. 12 months) the amount of 100*l.* will be 105*l.* then 105*l.* : 100*l.* :: 50*l.* : 47*l.* 12*s.* 4½*d.* present worth of the third payment. Hence 49*l.* 3*s.* 7¼*d.* + 48*l.* 7*s.* 8½*d.* + 47*l.* 12*s.* 4½*d.* = 145*l.* 3*s.* 8½*d.* the present worth required.

£.
(¹¹) First 3 mo. ¼) 5

To which add 100 0 £. s. d. { discount
Then as 101 5 : 1 5 :: 287 15 : 3 11 0½ } of the 1st payment

£.
Again 6 mo. ½) 5
2 10*s.*

To which add 100 0 £. s. d. { discount of
Then as 102 10 : 2 10 :: 287 15 : 7 0 4¼ } 2d payment
Sum 10 11 4½ discount req.

£.
(¹¹) First 6 mo. ½) 4
2

To which add 100 £. s. d. { present worth
Then as 102 : 100 :: 200 : 196 1 6¾ } of second payment.

Again, as 104 : 100 :: 200 : 192 6 1¼ } present worth
of third payment.

Sum 388 7 8½
Add 100 0 0 the sum paid down.
488 7 8½ present worth required.

EQUATION

EQUATION OF PAYMENTS.

£. m.		£. m.
(1) $40 \times 3 = 120$	(2) $200 \times 3 = 600$	
$60 \times 5 = 300$	$100 \times 4 = 400$	
$100 \times 10 = 1000$	$300 \times 5 = 1500$	
$2 00)14 20$	$200 \times 6 = 1200$	
<u><u>7 mo. $\frac{1}{10}$ Ans.</u></u>	$8 00)37 00$	
	<u><u>4 mo. $17\frac{1}{2}$ da. Ans.</u></u>	

£. m.		£. m.
(3) $120 \times 2 = 240$	(4) $100 \times 3 = 300$	
$200 \times 4 = 800$	$150 \times 6 = 900$	
$40 \times 5 = 200$	$250 \times 12 = 3000$	
$36 0)124 0$	$5 00)42 00$	
<u><u>3 mo. $12\frac{4}{9}$ da. Ans.</u></u>	<u><u>8 mo. $11\frac{1}{3}$ da. Ans.</u></u>	

£. m.		£. m.
(5) Suppose the debt 8,	(6) $60 \times 3 = 180$	
£. m.	$30 \times 6 = 180$	
then, $2 \times 2 = 4$	$30 \times 9 = 270$	
$1 \times 3 = 3$	$12 0)63 0$	
$2 \times 5 = 10$	<u><u>5 mo. 7 da. Ans.</u></u>	
$1 \times 6 = 6$		
$1 \times 7 = 7$		
$8)34$		
<u><u>$4\frac{1}{4}$ mo. Ans.</u></u>		

Though this method of finding the equated time is much practised on account of its easy mode of calculation, yet it is not strictly true, as it neither agrees with the principles of Simple or Compound Interest. However, where the whole time concerned is not long, it will deviate but little from the truth at Simple Interest.

The error of this method lies in making no difference between the interest and the discount, whereas the latter is ever less than the former. The equated time will therefore by this method be always something too great.

BARTER.

BARTER.

(1) First, $112lb. \times 2 \times 9 = 2016s.$ the value of the Tea, then $2016 \div 4 = 504lb.$ the quantity of Chocolate required.

(2) First, as $4d. : 5d. :: 32s. : \frac{32 \times 5}{4} = 40s.$ what B. ought to rate his Hops at in Barter; again, $112 \times 20 \times 5 = 11200d.$ value of the 20 cwt. of Prunes, therefore $11200 \div 480 = 23 cwt. 1 qr. 9\frac{1}{2}lb.$ the *Ans.*

(3) 4 cwt. 2 qrs. = 504lb. and $504lb. \times 4 = 2016s.$ value of the Chocolate, whence $2016 \div 9 = 224lb. = 2 cwt.$ the quantity of Tea required.

(4) First, $3l. 14s. \times 8 = 29l. 12s.$ price of the Cloth, and $1l. 1s. 6d. \times 20 = 21l. 10s.$ price of the Cheese, whence $29l. 12s. - 21l. 10s. = 8l. 2s.$ what B must receive of A in Barter.

(5) First, $13\frac{1}{2}d. \times 3\frac{1}{2} = 47\frac{1}{4}d. = 189 qrs. =$ to the value of the Pepper, hence $189 \div 61 = 3lb. 13\frac{5}{8}oz.$ the quantity of Ginger required.

qrs.	£.	s.	d.
(6) First, $2 - \frac{1}{2}$	1	17	4
			3
lb.	5	12	0
$14 - \frac{1}{4}$	0	18	8
$2 - \frac{1}{7}$	0	4	8
	0	0	8
	£. 6	16	0

$= 1632d.$ the value of the Tallow, whence $1632 \div 62 = 26 doz. 3\frac{3}{4}lb.$ the quantity of Candles that must be delivered in Barter for the said Tallow.

(7) First, $608yds. \times 14s. = 8512s.$ the value of the Cloth, then $8512s. - 2512s. \text{ or } (125l. 12s.) = 6000s.$ again $8512s. \div 2qr. 24lb. = 9600lb.$ therefore $\frac{112 \times 6000}{9600} = 3l. 10s.$ the price of B's. Bee-Wax per cent.

(8) First,

(⁸) First, $320 \text{ doz.} \times 54d. = 17280d.$ the value of A's candles, and $30l. = 7200d.$ then $17280d. - 7200d. = 10080d.$ again as $8d. : 1lb. :: 10080d. : 1260lb. = 11 \text{ cwt. } 1 \text{ qr.}$ the quantity of cotton A. receives, besides the cash.

(⁹) First, $114lb. \times 6d. = 684d.$ value of A's tobacco, then $14d. : 1lb. :: 684d. : 48\frac{3}{4}lb.$ the quantity of cotton B must give A. for his tobacco.

(¹⁰) As $90d. : 96d. :: 9d. : \frac{96 \times 9}{90} = 9\frac{1}{2}d. \frac{2}{3}$ how D ought to rate his tobacco in barter, that his profit may be equivalent with C's.

PROFIT AND LOSS.

(¹) First, $12s. 6d. - 10s. = 1s. 6d.$ gain per yard, then as $11s. : 18d. :: 2000s. = (100l.) : 2000 \times 18 \div 11 = 3272\frac{1}{11}d.$ which divided by 12 and 20 gives $13l. 12s. 8\frac{1}{11}d.$ the gain per cent.

(²) As $100l. : 108l. :: 18l. : 19\frac{1}{2}l. 8s. 9\frac{1}{2}d.$ the advanced price of the Holland, then as $60 \text{ ell.} : 19\frac{1}{2}l. 8s. 9\frac{1}{2}d. :: 1 \text{ ell.} : 6s. 5\frac{3}{4}d.$ the *Ans.* required.

(³) As $16d. : 20d. :: 100l. : 125l.$ then $125l. - 100l. = 25l.$ the gain per cent.

(⁴) Here we have as $112l. : 100l. :: 560l. : 500l.$ the prime cost required.

(⁵) As $13s. 4d. : 16s. :: 100l. : 120l.$ then $120l. - 100l. = 20l.$ the gain per cent.

(⁶) Here we have as $100l. : 115l. :: 27s. 6d. : 115 \times 27 \div 100 = 1l. 11s. 7\frac{1}{2}d.$ the *Ans.* required.

(⁷) First, as $120l. : 100l. :: 490l. : 408l. 6s. 8d.$ the prime cost of the Cloth, then as $375 \text{ yds.} : 408l. 6s. 8d. :: 1 \text{ yd.} : \frac{408l. 6s. 8d.}{375} = 1l. 1s. 9\frac{1}{4}d. \frac{1}{375}$ *Ans.* required.

(⁸) As

(8) As 60*l.* 15*s.* : 125*l.* :: 80*l.* : 164*l.* 12*s.* 2*d.* - $\frac{210}{1215}$
 from which deduct 100*l.* and there remains 64*l.* 12*s.* 2*d.* - $\frac{210}{1215}$
 the gain per cent.

(9) As 100*l.* : 118*l.* :: 60*l.* : $\frac{118 \times 60}{100} = \frac{118 \times 6}{10} = 70*l.*$
 16*s.* the advanced price of the cambric, then as 450*qrs.* =
 (90 *ells.*) : 70*l.* 16*s.* :: 4 *q's.* : $\frac{70*l.* 16*s.* \times 4}{450} = 12*s.* 7*d.* - $\frac{18}{450}$$

the *Ans.*

(10) As 112*l.* 10*s.* : 100*l.* :: 204*l.* 15*s.* : 182*l.* the prime
 cost of the lead, then as 195 *cwt.* : 182*l.* :: 1 *cwt.* : 18*s.*
 8*d.* the *Ans.* req.

	yds.	s.	s.	d.	
(11) First,	$436 \times 10\frac{1}{2}$	=	4505	4	what the cloth sold for.
and	$436 \times 8\frac{1}{2}$	=	3706	0	the price it cost.
then the diff.			799	4	= 39 <i>l.</i> 19 <i>s.</i> 4 <i>d.</i> gain of the whole.

(12) First, 69*l.* $\times 14$ = 966*l.* what was paid for the 14 tons
 of steel, and 2240*lb.* $\times 14 \div 2 \times 20$ = 784*l.* what it was sold
 for, whence 966*l.* - 784*l.* = 182*l.* what was lost by the sale.

(13) As 100*l.* : 115*l.* :: 32*l.* : 36*l.* 16*s.* the advanced
 price of the linen, then 124 *yds.* : 36*l.* 16*s.* :: 1 *yd.* : 5*s.*
 11*d.* - $\frac{28}{124}$ *Ans.*

	yds.	s.	s.	d.	
(14) First,	$249 \times 4\frac{1}{6}$	=	1037	6	retailing price of the Cloth.
and	$249 \times 3\frac{1}{3}$	=	830	9	prime cost of ditto.
diff.			207	6	= 10 <i>l.</i> 7 <i>s.</i> 6 <i>d.</i> the profit.

Again, as 830*s.* : 1037*½s.* :: 100*l.* : 125*l.* then 125*l.* - 100*l.*
 = 25*l.* the gain per cent.

FELLOWSHIP.

SINGLE FELLOWSHIP;

Or, FELLOWSHIP WITHOUT TIME.

stock. gain.

$$\begin{array}{lcl}
 \text{As } 60 : 50 :: & \left\{ \begin{array}{l} \text{£. } 20 : 16 \text{ } 13 \text{ } 4 = \text{A's} \\ \text{Or as } 6 : 5 :: \left\{ \begin{array}{l} \text{£. } 40 : 33 \text{ } 6 \text{ } 8 = \text{B's} \end{array} \right. \end{array} \right. & \text{gain.} \\
 & \underline{\underline{50 \text{ } 0 \text{ } 0}} & \text{proof.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{As } \text{£. } 90 : \text{£. } 180 :: & \left\{ \begin{array}{l} \text{£. } 20 : 40 = \text{A's} \\ \text{Or as } 1 : 2 :: \left\{ \begin{array}{l} 30 : 60 = \text{B's} \\ 40 : 80 = \text{C's} \end{array} \right. \end{array} \right. & \text{gain.} \\
 & \underline{\underline{180}} & \text{proof.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{As } \text{£. } 1346 : \text{£. } 867 :: & \left\{ \begin{array}{l} \text{£. } 364 : 234 \text{ } 9 \text{ } 3\frac{1}{4} - 70 = \text{A's} \\ 482 : 310 \text{ } 9 \text{ } 5 - 248 = \text{B's} \\ 500 : 322 \text{ } 1 \text{ } 3\frac{1}{2} - 1028 = \text{C's} \end{array} \right. & \text{gain.} \\
 & \underline{\underline{867 \text{ } 0 \text{ } 0}} & \text{proof.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{As } \text{£. } 1130 : \text{£. } 428 :: & \left\{ \begin{array}{l} \text{£. } 227 : 85 \text{ } 19 \text{ } 6\frac{3}{4} - 690 = \text{B's} \\ 349 : 132 \text{ } 3 \text{ } 9 - 120 = \text{C's} \\ 115 : 43 \text{ } 11 \text{ } 1\frac{3}{4} - 250 = \text{D's} \\ 439 : 166 \text{ } 5 \text{ } 6\frac{1}{4} - 70 = \text{E's} \end{array} \right. & \text{gain.} \\
 & \underline{\underline{428 \text{ } 0 \text{ } 0}} & \text{proof.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{As } \text{£. } 1710 : \text{£. } 684 :: & \left\{ \begin{array}{l} \text{£. } 750 : 300 = \text{D's} \\ 460 : 184 = \text{E's} \\ 500 : 200 = \text{F's} \end{array} \right. & \text{gain.} \\
 & \underline{\underline{684}} & \text{proof.}
 \end{array}$$

(6) As

Fellowship.

III

$$\begin{array}{rcl}
 \text{£. s.} & \text{£. s.} & \text{£. s. d.} \\
 \text{As } 836 & 7 : 675 & 15 :: \left\{ \begin{array}{l} 275 \ 14 : 222 \ 15 \ 2-6584 = \text{B's} \\ 304 \ 7 : 245 \ 18 \ 1\frac{1}{2}-15750 = \text{C's} \\ 152 \ 0 : 122 \ 16 \ 2\frac{3}{4}-12227 = \text{D's} \\ 104 \ 6 : 84 \ 5 \ 5-15620 = \text{E's} \end{array} \right\} \text{gain.} \\
 & & \underline{\underline{675 \ 15 \ 0 \text{ proof.}}}
 \end{array}$$

(7) As the stock is not given, we may suppose it any sum we choose, in the present case let it be 60l. then the one-third, one-fourth, one-fifth, and one-sixth thereof is just 57l. whence we have

$$\begin{array}{rcl}
 \text{£.} & \text{£. s. d.} & \\
 \text{As } 57 : 60 :: \left\{ \begin{array}{l} 20 : 21 \ 1 \ 0\frac{1}{2}-\frac{30}{57} = \text{A's} \\ 15 : 15 \ 15 \ 9\frac{1}{4}-\frac{51}{57} = \text{B's} \\ 12 : 12 \ 12 \ 7\frac{1}{2}-\frac{18}{57} = \text{C's} \\ 10 : 10 \ 10 \ 6\frac{1}{4}-\frac{15}{57} = \text{D's} \end{array} \right\} \text{stock.} \\
 & \underline{\underline{60 \ 0 \ 0 \text{ proof.}}} &
 \end{array}$$

$$\begin{array}{rcl}
 \text{£.} & \text{£. s.} & \text{£. s. d.} \\
 \text{Again as } 60 : 100 :: \left\{ \begin{array}{l} 21 \ 1 \ 0\frac{1}{2}-\frac{30}{57} : 35 \ 1 \ 9-48 \\ 15 \ 15 \ 9\frac{1}{4}-\frac{51}{57} : 26 \ 6 \ 3\frac{3}{4}-36 \\ \text{Or, as } 6 : 10 :: \left\{ \begin{array}{l} 12 \ 12 \ 7\frac{1}{2}-\frac{18}{57} : 21 \ 1 \ 0\frac{1}{2}-120 \\ 10 \ 10 \ 6\frac{1}{4}-\frac{15}{57} : 17 \ 10 \ 10\frac{1}{2}-24 \end{array} \right\} = \\
 \text{A, B, C, and D's gain.} & & \underline{\underline{100 \ 0 \ 0 \text{ proof.}}}
 \end{array} \right.
 \end{array}$$

(8) The interest and land-tax as mentioned in this question, might puzzle a learner, but they will please to observe that they are not brought at all into the solution, as the time between buying and selling of the estate is not specified.

First then, $1700l. \times 24 = 40800l.$ what they sold the estate for.

$$\begin{array}{rcl}
 \text{£.} & \text{£.} & \text{£.} \\
 \text{Again, as } 27200 : 40800 :: \left\{ \begin{array}{l} 15000 : 22500 = \text{D's} \\ 12200 : 18300 = \text{E's} \end{array} \right\} \text{share.} \\
 & & \underline{\underline{40800 \text{ proof.}}}
 \end{array}$$

$$(9) \text{ As } 4+6+8=18:647:: \begin{array}{r} \text{£.} \\ 4:143 \ 15 \ 6\frac{1}{8}=D's \\ 6:215 \ 13 \ 4=E's \\ 8:287 \ 11 \ 1\frac{6}{8}=F's \end{array} \left. \vphantom{\begin{array}{r} \text{£.} \\ 4:143 \ 15 \ 6\frac{1}{8}=D's \\ 6:215 \ 13 \ 4=E's \\ 8:287 \ 11 \ 1\frac{6}{8}=F's \end{array}} \right\} \text{stock.}$$

$$\underline{\underline{647 \ 0 \ 0 \text{ proof.}}}$$

$$\text{Again as } \begin{array}{r} \text{£.} \\ 647:143 \ 15 \ 6\frac{1}{8}:: \end{array} \begin{array}{r} \text{£.} \ s. \ d. \\ 143 \ 15 \ 6\frac{1}{8}:31 \ 19 \ 0-207040 \\ 215 \ 13 \ 4:47 \ 18 \ 6-310560 \\ 287 \ 11 \ 1\frac{6}{8}:63 \ 18 \ 0-414080 \end{array}$$

$$\underline{\underline{143 \ 15 \ 6\frac{1}{8} \text{ proof.}}}$$

=D, E, and F's gain.

$$(10) \text{ As } 3+5+8=16: \begin{array}{r} \text{£.} \\ 3 \\ 5 \\ 8 \end{array} :: \begin{array}{r} \text{£.} \\ 100: \end{array} \begin{array}{r} \text{£.} \ s. \\ 18 \ 15=D's \\ 31 \ 5=E's \\ 50 \ 0=F's \end{array} \left. \vphantom{\begin{array}{r} \text{£.} \\ 100: \end{array}} \right\} \text{stock}$$

$$\underline{\underline{100 \ 0 \text{ proof.}}}$$

DOUBLE FELLOWSHIP; Or, FELLOWSHIP WITH TIME.

$$(1) \begin{array}{l} 40 \times 3 \\ 75 \times 4 \end{array} \left. \vphantom{\begin{array}{l} 40 \times 3 \\ 75 \times 4 \end{array}} \right\} = \begin{array}{r} \text{Prod.} \\ 120 \\ 300 \end{array} = \begin{array}{r} \{D's\} \\ \{E's\} \end{array} \text{ Stock } \times \text{ ed into his } \text{time.}$$

$$\underline{\underline{420 \text{ the sum of the products.}}}$$

$$\text{As } 420:70:: \begin{array}{r} \text{£.} \\ 120:20=D's \\ 300:50=E's \end{array} \left. \vphantom{\begin{array}{r} \text{£.} \\ 120:20=D's \\ 300:50=E's \end{array}} \right\} \text{gain.}$$

$$\text{Or, as } 6:1:: \begin{array}{r} \text{£.} \\ 300:50=E's \end{array} \left. \vphantom{\begin{array}{r} \text{£.} \\ 300:50=E's \end{array}} \right\}$$

$$\underline{\underline{70 \text{ proof.}}}$$

$$(2) \begin{array}{l} d. \\ 46968 \times 3 \\ 43179 \times 5 \\ 14338 \times 11 \end{array} \left. \vphantom{\begin{array}{l} d. \\ 46968 \times 3 \\ 43179 \times 5 \\ 14338 \times 11 \end{array}} \right\} = \begin{array}{r} \text{Prod.} \\ 140904 \\ 215895 \\ 157718 \end{array} = \begin{array}{r} \{D's\} \\ \{E's\} \\ \{F's\} \end{array} \text{ Stock in pence } \times \text{ ed into his } \text{time.}$$

$$\underline{\underline{514517 \text{ sum of the products.}}}$$

As $\begin{matrix} \text{£.} & \text{s.} & \text{d.} \\ 514517 : 364 & 18 : : \end{matrix} \left\{ \begin{matrix} 140904 : 99 & 18 & 7-589972 \\ 215895 : 153 & 2 & 3\frac{1}{2}-28250 \\ 157718 : 111 & 17 & 1-410812 \end{matrix} \right\} =$

D, E, and F's gain.

$\begin{matrix} 364 & 18 & 0 \text{ proof.} \\ \hline \hline \end{matrix}$

(3) $\begin{matrix} 500 \times 5 = 2500 \\ 300 \times 5 = 1500 \\ 600 \times 4 = 2400 \\ 470 \times 4 = 1880 \\ \hline 8280 \text{ for D.} \end{matrix} \left. \begin{matrix} \text{add.} \end{matrix} \right\} \begin{matrix} 400 \times 3 = 1200 \\ 670 \times 6 = 4020 \\ 530 \times 3 = 1590 \\ 630 \times 3 = 1890 \\ 531 \times 3 = 1593 \\ \hline 10293 \text{ for E.} \end{matrix} \left. \begin{matrix} \text{add.} \end{matrix} \right\}$

$\begin{matrix} 900 \times 6 = 5400 \\ 700 \times 5 = 3500 \\ 1200 \times 2 = 2400 \\ 600 \times 5 = 3000 \\ \hline 14300 \text{ for F.} \end{matrix} \left. \begin{matrix} \text{add.} \end{matrix} \right\}$

Then $8280 + 10293 + 14300 = 32872$, the sum of the products,

Therefore as $\begin{matrix} \text{£.} & \text{s.} & \text{d.} \\ 32873 : 200 : : \end{matrix} \left\{ \begin{matrix} 8280 : 50 & 7 & 6 -21720 \\ 10293 : 62 & 12 & 5\frac{1}{4}-29859 \\ 14300 : 87 & 0 & 0\frac{1}{4}-14167 \end{matrix} \right\} =$

D, E, and F's gain.

$\begin{matrix} 200 & 0 & 0 \\ \hline \hline \end{matrix}$

(4) $\begin{matrix} \text{oxen.} & \text{prod.} \\ 23 \times 27 \\ 21 \times 35 \\ 16 \times 23 \end{matrix} \left\{ \begin{matrix} 621 \\ 735 \\ 368 \end{matrix} \right\} \begin{matrix} \text{The product of each man's oxen} \\ \text{×ed by the days they were} \\ \text{feeding.} \end{matrix}$

$\begin{matrix} 1724 \\ \hline \hline \end{matrix}$ Sum of the products.

Then as $\begin{matrix} \text{d.} & \text{£.} & \text{s.} & \text{d.} \\ 1724 : 8766 : : \end{matrix} \left\{ \begin{matrix} 621 : 13 & 3 & 1\frac{1}{2} -624 = \text{D's} \\ 735 : 15 & 11 & 5 -1688 = \text{E's} \\ 368 : 7 & 15 & 11 -1136 = \text{F's} \end{matrix} \right\} \begin{matrix} \text{Sum.} \\ \hline \hline \end{matrix}$

$\begin{matrix} 36 & 10 & 6 \text{ proof.} \\ \hline \hline \end{matrix}$

NOTE. We have mostly adhered strictly to the rules of our author, both in Fellowship and other parts of the work, yet many advantages may be obtained, especially if one be mindful to embrace every contraction that may present itself in the operation.

ALLIGATION.

ALLIGATION MEDIAL.

buſh. s. s.

(¹) $20 \times 5 = 100$ value of the wheat.

$36 \times 3 = 108$ value of the rye.

$40 \times 2 = 80$ value of the barley.

$\begin{array}{r} 96 \\ \hline \end{array}$ $\begin{array}{r})288 \\ \hline \end{array}$ ($3s.$ the mean rate, or value of a buſhel of the maſlin.

gal. s. d. s. d.

(²) $15 \times 8 = 120$ 0 value of the Canary.

$20 \times 7 = 146$ 8 — of 20 gals. of ditto.

$10 \times 6 = 66$ 8 — of the Sherry.

$24 \times 4 = 96$ 0 — of the White Wine.

$\begin{array}{r} 69 \\ \hline \end{array}$ $\begin{array}{r})429 \\ \hline \end{array}$ 4 ($6s. 2\frac{1}{2}d. - \frac{4}{9}$, the answer required.

cwt. s.

s.

(³) $\left. \begin{array}{l} 4 \times 56 \\ 7 \times 43 \\ 5 \times 37 \end{array} \right\} = \left\{ \begin{array}{l} 224 \\ 310 \\ 185 \end{array} \right\}$ value of the different parcels of ſugar.

As 16 : 710 : 2 cwt. : 88s. 9d. = 4l. 8s. 9d. the answer required.

qu. s.

s.

(⁴) $\left. \begin{array}{l} 30 \times 28 \\ 46 \times 30 \\ 24 \times 25 \end{array} \right\} = \left\{ \begin{array}{l} 840 \\ 1380 \\ 600 \end{array} \right\}$ value of the brown malt.
pale ditto.
high dried ditto.

$\begin{array}{r} 100 \\ \hline \end{array}$ $\begin{array}{r})2820 \\ \hline \end{array}$ ($1l. 8s. 2\frac{1}{4}d. - \frac{6}{20}$, the answer.

Alligation.

115

$$\begin{array}{r} \text{bu} \text{ sh. } s. \quad d. \\ (5) \quad 27 \times 5 \quad 6 \\ \quad 27 \times 4 \quad 0 \\ \quad 14 \times 2 \quad 8 \\ \hline \quad 68 \\ \hline \end{array} = \left\{ \begin{array}{r} 148 \quad 6 \\ 108 \quad 0 \\ 37 \quad 4 \\ \hline 293 \quad 10 \end{array} \right\} \begin{array}{l} \text{value of the different} \\ \text{compounds.} \end{array}$$

$(4s. \quad 3\frac{3}{4}d. - \frac{28}{68}, \text{ value of a bushel of the mixture.}$

$$\begin{array}{r} \text{cwt. } s. \quad d. \\ (6) \quad 3 \times 56 \quad 0 \\ \quad 6 \times 37 \quad 4 \\ \quad 3 \times 74 \quad 8 \\ \hline \quad 12 \\ \hline \end{array} = \left\{ \begin{array}{r} 168 \\ 224 \\ 224 \\ \hline 616 \end{array} \right\} \begin{array}{l} \text{value of the parcels of sugar.} \\ (5 \text{ } s. \quad 4d. = 2 \text{ } l. \quad 11 \text{ } s. \quad 4d. \text{ the answer required.} \end{array}$$

$$\begin{array}{r} \text{bu} \text{ sh. } s. \quad d. \\ (7) \quad 3 \times 3 \quad 5 \\ \quad 4 \times 5 \quad 6 \\ \quad 5 \times 4 \quad 8 \\ \hline \quad 12 \\ \hline \end{array} = \left\{ \begin{array}{r} 10 \quad 3 \\ 22 \quad 0 \\ 23 \quad 4 \\ \hline 55 \quad 7 \end{array} \right\} \begin{array}{l} \text{value of the mixtures.} \\ (4s. \quad 7\frac{1}{2}d. - \frac{1}{3}, \text{ the answer req.} \end{array}$$

$$\begin{array}{r} \text{gal. } s. \quad d. \\ (8) \quad 20 \times 5 \quad 4 \\ \quad 12 \times 5 \quad 0 \\ \quad 30 \times 6 \quad 0 \\ \quad 20 \times 4 \quad 6 \\ \hline \quad 82 \\ \hline \end{array} = \left\{ \begin{array}{r} 106 \quad 8 \\ 60 \quad 0 \\ 180 \quad 0 \\ 90 \quad 0 \\ \hline 436 \quad 8 \end{array} \right\} \begin{array}{l} \text{value of the Port.} \\ \text{White Wine.} \\ \text{Lisbon.} \\ \text{Mountain.} \\ (5s. \quad 3\frac{3}{4}d. - \frac{50}{82}, \text{ the answer.} \end{array}$$

$$\begin{array}{r} \text{bu} \text{ sh. } s. \\ (9) \quad 20 \times 5 \\ \quad 36 \times 3 \\ \quad 40 \times 2 \\ \hline \quad 96 \\ \hline \end{array} = \left\{ \begin{array}{r} 100 \text{ value of the Wheat.} \\ 108 \text{ Rye.} \\ 80 \text{ Barley.} \\ \hline 288 \end{array} \right\} (3s. \text{ value of a bushel of the maslin.}$$

(10) First $2s. \quad 6d. + 4s. \quad 6d. = 7s.$ then $7s. \div 2 = 3s. \quad 6d.$ the answer required.

(11) 12

Alligation.

$$\begin{array}{r}
 \text{lb. oz.} \quad \text{oz.} \\
 (11) \left. \begin{array}{l} 12 \times 6 \\ 8 \times 7 \\ 10 \times 8 \end{array} \right\} = \left\{ \begin{array}{l} 72 \\ 56 \\ 80 \end{array} \right\} \text{the different mixtures.} \\
 \underline{30} \quad \underline{208} (6 \text{ oz. } 10 \text{ drs. } 16 \text{ gr. the fineness of } \\
 \text{1 lb. of this composition.}
 \end{array}$$

$$\begin{array}{r}
 \text{busb. s.} \quad \text{s.} \\
 (12) \left. \begin{array}{l} 40 \times 4 \\ 10 \times 6 \\ 30 \times 5 \\ 20 \times 3 \end{array} \right\} = \left\{ \begin{array}{l} 160 \\ 60 \\ 150 \\ 60 \end{array} \right\} \text{value of the different mixtures.} \\
 \underline{20} \quad \underline{430}
 \end{array}$$

As 100 : 430 :: 10 busb. : 43s. = 2l. 3s. the answer required.

$$\begin{array}{r}
 \text{lb. d.} \quad \text{d.} \\
 (13) \left. \begin{array}{l} 50 \times 11 \\ 30 \times 14 \\ 25 \times 22 \\ 37 \times 24 \end{array} \right\} = \left\{ \begin{array}{l} 550 \\ 420 \\ 550 \\ 888 \end{array} \right\} \text{value of the mixtures.} \\
 \underline{142} \quad \underline{2404} (16 \frac{1}{4} \text{ l. } - 1 \frac{1}{4} \text{ s. } \text{Ans.})
 \end{array}$$

ALLIGATION ALTERNATE.

$$\begin{array}{r}
 \text{d.} \quad \text{qt.} \\
 (1) \left. \begin{array}{l} 18 \text{ — } \\ 20 \text{ — } \\ 24 \text{ — } \\ 28 \text{ — } \end{array} \right\} \begin{array}{l} 2 \\ 6 \\ 4 \\ 2 \end{array} = \text{to the quarts of each sort re-} \\
 22 \quad \text{spectively.}
 \end{array}$$

Which may be proved thus :

$$\begin{array}{r}
 \text{d.} \quad \text{q.} \\
 \left. \begin{array}{l} 2 \text{ quarts at } 18 \\ 6 \text{ — at } 20 \\ 4 \text{ — at } 24 \\ 2 \text{ — at } 28 \end{array} \right\} \text{per quart} \left\{ \begin{array}{l} 36 \\ 120 \\ 96 \\ 56 \end{array} \right\} \text{amount to} \\
 \underline{14} \text{ total quantity.} \quad \underline{308} \text{ Total amount}
 \end{array}$$

Then $308 \div 14 = 22d.$ the mean rate.

Questions

Questions of this kind are called by algebraists indeterminate, because they admit of answers *ad infinitum*: In the solution above, although 2, 6, &c. do truly answer the conditions of the question, yet any numbers that bear the same proportion to each other, as 2 to 6, &c. will as truly answer it.

$$\begin{array}{rcl}
 & d. & lb. \\
 (2) & \begin{array}{r|l} 4 & 2 \\ 6 & 2 \\ 10 & 4+2 \end{array} & \left. \begin{array}{l} 2 \\ 2 \\ 6 \end{array} \right\} \text{quantity of each sort.}
 \end{array}$$

$$\begin{array}{rcl}
 & d. & lb. \\
 (3) & \begin{array}{r|l} 16 & 1 \\ 10 & 14 \\ 9 & 6 \\ 8 & 4 \end{array} & \left. \begin{array}{l} 1 \\ 2 \\ 6 \\ 4 \end{array} \right\} \text{the quantity of each sort respectively}
 \end{array}$$

$$\begin{array}{rcl}
 & d. & bush. \\
 (4) & \begin{array}{r|l} 42 & 6 \\ 30 & 6 \\ 24 & 12+18 \end{array} & \left. \begin{array}{l} 6 \text{ of barley.} \\ 6 \text{ — rye.} \\ 30 \text{ — oats.} \end{array} \right\} \text{Ans.}
 \end{array}$$

$$\begin{array}{rcl}
 & d. & lb. \\
 (5) & \begin{array}{r|l} 7 & 1 \\ 5 & 1 \\ 4 & 2+1 \end{array} & \left. \begin{array}{l} 1 \text{ of Raisins of the Sun.} \\ 1 \text{ — Malagas.} \\ 3 \text{ — Smyrnas.} \end{array} \right\} \text{Ans.}
 \end{array}$$

$$\begin{array}{rcl}
 & d. & lb. \\
 (6) & \begin{array}{r|l} 24 & 5+2 \\ 20 & 4 \\ 15 & 4 \end{array} & \left. \begin{array}{l} 7 \\ 4 \\ 4 \end{array} \right\} \text{quantity of each sort.}
 \end{array}$$

ALLIGATION PARTIAL.

$$\begin{array}{rcl}
 & d. & \\
 (1) & \begin{array}{r|l} 15 & 5 \\ 17 & 1 \\ 18 & 1 \\ 22 & 2 \end{array} & \left. \begin{array}{l} 5 \\ 1 \\ 1 \\ 2 \end{array} \right\} \text{the differences found by Alligation Alternate.}
 \end{array}$$

These

These differences are not the very quantities that the limits of the question require, but corresponding proportionals to them, from which the quantities themselves may be found by our author's rule, thus,

As 5 : 20 :: $\left\{ \begin{array}{l} 1 : 4 \\ 1 : 4 \\ 2 : 8 \end{array} \right\}$ the pounds of each sort to be mixed with the 20^{lb.} of tobacco respectively.

d.

$$(1) \begin{array}{r} 60 \\ 32 \\ 24 \\ 18 \end{array} \begin{array}{|l} \hline \\ \hline \\ \hline \\ \hline \end{array} \begin{array}{r} 8 \\ 14 \\ 28 \\ 4 \end{array} \left. \vphantom{\begin{array}{r} 60 \\ 32 \\ 24 \\ 18 \end{array}} \right\} \text{The differences found as before.}$$

Then as 8 : 20 :: $\left\{ \begin{array}{l} 14 : 35 \text{ bush. of Rye} \\ 28 : 70 \text{ ————— Barley} \\ 4 : 10 \text{ ————— Oats} \end{array} \right\}$ to be mixed with the 20 bush. of wheat

d.

$$(3) \begin{array}{r} 48 \\ 42 \\ 24 \\ 18 \end{array} \begin{array}{|l} \hline \\ \hline \\ \hline \\ \hline \end{array} \begin{array}{r} 24 + 18 + 6 \\ 6 \\ 6 \\ 6 \end{array} \left. \vphantom{\begin{array}{r} 48 \\ 42 \\ 24 \\ 18 \end{array}} \right\} \begin{array}{l} 48 \\ 6 \\ 6 \\ 6 \end{array} \left. \vphantom{\begin{array}{r} 48 \\ 6 \\ 6 \\ 6 \end{array}} \right\} \text{differences found as before.}$$

Then as 6 : 12 :: $\left\{ \begin{array}{l} 48 : 96 \text{ bush. of Wheat} \\ 6 : 12 \text{ ————— Rye} \\ 6 : 12 \text{ ————— Barley} \end{array} \right\}$ to be mixed with the 12 bush. of Oats.

(4) $\begin{array}{r} 12 \\ 8 \\ 7 \\ 4 \end{array} \begin{array}{|l} \hline \\ \hline \\ \hline \\ \hline \end{array} \begin{array}{r} 4 + 1 \\ 4 \\ 4 \\ 4 \end{array} \left. \vphantom{\begin{array}{r} 12 \\ 8 \\ 7 \\ 4 \end{array}} \right\} \begin{array}{l} 5 \\ 4 \\ 4 \\ 4 \end{array} \left. \vphantom{\begin{array}{r} 5 \\ 4 \\ 4 \\ 4 \end{array}} \right\} \text{the differences found as before.}$

Then as 5 : 40 :: $\left\{ \begin{array}{l} 4 : 32 \text{ gals. of English} \\ 4 : 32 \text{ ————— spirits} \end{array} \right\}$ to be mixed with the 40 gals. of French Brandy.

s.

$$(5) \begin{array}{r} 12 \\ 10 \\ 6 \\ 4 \end{array} \begin{array}{|l} \hline \\ \hline \\ \hline \\ \hline \end{array} \begin{array}{r} 4 \\ 2 \\ 2 \\ 4 \end{array} \left. \vphantom{\begin{array}{r} 12 \\ 10 \\ 6 \\ 4 \end{array}} \right\} \text{the differences found as before.}$$

Then

Then as 4 : 20 :: { 4 : 20 *lbs.* at 12 } to be mixed with
 Or, as 1 : 5 :: { 2 : 10 — 10 } the 20 *lb.* at 4*s.* per
 { 2 : 10 — 6 } *lb.*

(6)
$$\begin{array}{r|l} d. & \\ 81 & 12 \\ 90 & 9 \\ 60 & 9 \\ 63 & 18 \end{array}$$
 } the differences as before.

Then as 12 : 18 :: { 9 : 13½ gals. of Malaga }
 Or, as 2 : 3 :: { 9 : 13½ — Sherry }
 { 18 : 27 — White Wine }

to be mixed with 18 gals. of Canary at 6*s.* 9*d.* per gallon.

ALLIGATION TOTAL.

(1)
$$\begin{array}{r|l} d. & \\ 12 & 4 \\ 10 & 2 \\ 6 & 2 \\ 4 & 4 \\ \hline & 12 \end{array}$$
 } the differences found as before.
 = the sum of the differences.

Then as 12 : 144 :: { 4 : 48 } the number of pounds of
 Or, as 1 : 12 :: { 2 : 24 } each sort required.
 { 2 : 24 }
 { 4 : 48 }

(2)
$$\begin{array}{r|l} s. & \\ 5 & 1 \\ 6 & 2 \\ 7 & 2 \\ 9 & 1 \\ \hline & 6 \end{array}$$
 } the differences found as before.
 = the sum of the differences.

2

Then

Then as 6 : 87 :: $\left\{ \begin{array}{l} 1 : 14\frac{1}{2} \\ 2 : 29 \\ 2 : 29 \\ 1 : 14\frac{1}{2} \end{array} \right\}$ the quantity of each sort req.

(3) $\begin{array}{r} \text{lb.} \\ \begin{array}{r} 4 \text{ --- } 5 + 3 + 1 \\ 6 \text{ --- } 1 \\ 8 \text{ --- } 1 \\ 10 \text{ --- } 1 \end{array} \end{array} \left\{ \begin{array}{l} 9 \\ 1 \\ 1 \\ 1 \end{array} \right\} \text{ the differences found as before.}$
 $\underline{12}$ the sum of the differences.

Then as 12 : 60 :: $\left\{ \begin{array}{l} 9 : 45 \\ 1 : 5 \\ 1 : 5 \\ 1 : 5 \end{array} \right\}$ the quantity of each sort
 or, as 1 : 5 :: $\left\{ \begin{array}{l} 1 : 5 \\ 1 : 5 \\ 1 : 5 \end{array} \right\}$ req.

(4) $\begin{array}{r} \text{gal.} \\ \begin{array}{r} 11 \text{ --- } 4 \\ 9 \text{ --- } 2 \\ 6 \text{ --- } 1 \\ 4 \text{ --- } 3 \end{array} \end{array} \left\{ \begin{array}{l} 2 \\ 1 \\ 1 \\ 3 \end{array} \right\} \text{ the differences found as before.}$
 $\underline{10}$ the sum of the differences.

Then as 10 : 240 :: $\left\{ \begin{array}{l} 4 : 96 \\ 2 : 48 \\ 1 : 24 \\ 3 : 72 \end{array} \right\}$ the quantity of each sort
 or, as 1 : 24 :: $\left\{ \begin{array}{l} 1 : 24 \\ 1 : 24 \\ 1 : 24 \\ 1 : 24 \end{array} \right\}$ req.

(5) $\begin{array}{r} \text{carats.} \\ \begin{array}{r} 24 \text{ --- } 2 \\ 22 \text{ --- } 2 \\ 20 \text{ --- } 2 \\ 15 \text{ --- } 7 + 5 + 3 \end{array} \end{array} \left\{ \begin{array}{l} 2 \\ 2 \\ 2 \\ 15 \end{array} \right\} \text{ the differences found as before.}$
 $\underline{21}$ the sum of the differences.

Then as 21 : 42, or as 1 : 2 :: 2 : 4oz. the quantity of 24, 22, and 20 carats fine respectively; again as 1 : 2 :: 15 : 30oz. the quantity of 15 carats fine.

$$\begin{array}{r}
 (1) \quad \begin{array}{r} 8-1-2+13 \\ 7 \quad 6 \quad 5-1-2 \\ 4-2 \end{array} \left. \begin{array}{l} 1st. diff. \\ 2nd. diff. \end{array} \right\} \begin{array}{r} 3+25 \\ 1 \quad 1 \\ 1 \quad 1 \end{array} \left. \begin{array}{l} 1st. diff. \\ 2nd. diff. \end{array} \right\} \begin{array}{l} \text{diff. found as} \\ \text{before.} \end{array} \\
 \hline
 7 \quad \text{sums of} \quad 7 \quad \text{the differences.}
 \end{array}$$

Then as 7 : 28, or as 1 : 4 :: 3 : 12 *lb.* quantity of drugs at 8*s.* per *lb.*; and as 1 : 4 :: 2 : 8 *lb.* the quantity of 5*s.* and 4*s.* per *lb.* respectively; again, for the second part of the question, as 7 : 42, or as 1 : 6 :: 5 : 30 *lb.* the quantity of 8*s.* per *lb.* and as 1 : 6 :: 1 : 6 *lb.* the quantity of 5*s.* and 4*s.* as was required.

SINGLE POSITION,

Or, THE RULE OF FALSE.

(1) Suppose he had 40 scholars, then as many, half as many, and one quarter as many more will be $= 40 + 40 + 20 + 10 = 110$ the false conclusion; then as $110 : 88 :: 40 : 88 \times 40 / 110 = 8 \times 4 = 32$ the number of Scholars required.

(2) Suppose the person had 12 Portugal pieces.

then the one third is $\frac{4}{3}$
 one fourth $\frac{3}{4}$
 and the one sixth $\frac{2}{6}$

the sum is $\frac{9}{6}$, the false conclusion; then as 9 : 54, or as 1 : 6 :: 12 : 72 the number of Portugal pieces required.

(3) Suppose the price of the horse to be £. 2

then will the price of the harness be 1

and that of the chaise 6

the sum is $\frac{9}{6}$, the false conclusion, then as 9 : 60, or as 3 : 20 :: 2 : 13*s.* 6*d.* 8*d.* the price of the horse, then will the price of the harness and chaise be 6*l.* 13*s.* 4*d.* and 40*s.* respectively.

L

(4) Suppose

(4) Suppose A's part to be 12*l*. then by the tenour of the question must B's be 16*l*. and C's 20*l*. Now $12 + 16 + 20 = 48$ *l*. the false conclusion,

$$\begin{array}{l} \text{Then as } \begin{array}{cc} \text{£.} & \text{£.} \\ 48 & : 120 : : \end{array} \left\{ \begin{array}{cc} \text{£.} & \text{£.} \\ 12 & : 30 \\ 16 & : 40 \\ 20 & : 50 \end{array} \right\} \text{ what } \left\{ \begin{array}{c} A \\ B \\ C \end{array} \right\} \text{ Pays.} \\ \text{or as } 4 : 10 : : \end{array}$$

(5) Suppose the Maid had got 2 Geese

then as many more is

and half as many more

$$\begin{array}{c} 2 \\ 1 \\ \hline 3 \end{array}$$

sum 5, but should have been

$(30 - 5 =) 25$; therefore by the rule as 5 : 25, or as 1 : 5 :: 2 : 10, the number of Geese required.

(6) Suppose the sum lent to have been $\begin{array}{c} \text{£.} \\ 200 \end{array}$
then the int. of the same for the time is 120

sum is $\begin{array}{c} 320 \\ \hline \end{array}$ the false con-

clusion; then as 320*l*. : 300*l*. :: 200*l*. : 187*l*. 10*s*. the sum lent.

DOUBLE POSITION.

(1) Suppose A. had 40*l*. then $40 + 46 + 54 = 140$ *l*. the result, but it ought to have been 200*l*. therefore the error is 60*l*. in defect. Again, suppose A had 50*l*. then $50 + 56 + 64 = 170$ *l*. the result; but it ought to have been 200*l*. therefore the error is 30*l*. in defect: Here the errors are of alike kind, whence by the rule $\frac{50 \times 60 - 40 \times 30}{60 - 30} = 60$ *l*. A's share, then will B's share be 66*l*. and C's. 74*l*. as was req.

(2) Suppose the weight of the lesser cup to be 1 oz. then by the question $1 + 5 = 6$ oz. double the weight of the greater and $3 + 5 = 8$ oz. which should have been $= 3$ oz. therefore the error is 5 oz. Again, suppose the weight of the lesser cup 5 oz. then by the question $5 + 5 = 10$ oz. double the weight of

of the greater, and $5+5=10$ oz. which should have been =
 15 oz. therefore the error is 5 oz. Here the errors are un-
 like, whence by the rule $\frac{5 \times 1 + 5 \times 5}{5+5} = 3$ oz. weight of the
 lesser, and then will 4 oz. be the weight of the greater.

(3) Sup. A got 16 guineas then B got 32 and C <u>8</u> sum <u>56</u> too little by 140	Again, sup. A got 34 guineas then B got 50 and C <u>14</u> sum <u>98</u> too little by 98.
--	--

Hence by the rule $\frac{140 \times 34 - 98 \times 16}{140 - 98} = 76$ the num-
 ber A got.

then B got 92
 and C 28
196 proof.

(*) Suppose the value of the horse 10
 then the value of the garden is 40
 and that of the house 200
 sum 250 too little by 250.

Again, suppose the value of the horse 30
 then the value of the garden is 120
 and that of the house 600
 sum 750, too much by 250.

Therefore by the rule $\frac{250 \times 30 + 250 \times 10}{250 + 250} = 20$! value of
 the horse. then the value of the garden is = 80
 and that of the house = 400
500 proof.

(5) Suppose K's age 40, then is L's 40, but by the question it ought to have been 70, therefore the error is 30, in defect.—Again, suppose K's age 60, then is L's 120, but by the question it ought to have been 90, therefore, the error is 30 in excess. Whence by the rule $\frac{30 \times 60 + 30 \times 40}{30 + 30} = 50$ K's age, hence L's = 80.

(6) Suppose D got 15 cr. then E must have got 30 cr. and F 9 cr. by the question; now $15 + 30 + 9 = 54$ cr. therefore the error is 270 cr. in defect.—Again, suppose D got 150 cr. then E must have got 165 cr. and F 63 cr. by the question; now $150 + 165 + 63 = 378$ cr. therefore the error is 54 in excess; hence by the rule $\frac{150 \times 270 + 15 \times 54}{270 + 54} = 127\frac{1}{2}$ the number D got, then E got $142\frac{1}{2}$, and F 54.

(7) Suppose A had 20 apples.	Again, sup. A had 36 apples.
then B got 10	then B got 18
add 10	add 10
2)20	2)28
C got 10	C got 14
add 4	add 4
2)14	2)18
and D 7	and D 9
add 1	add 1
too little by five 8	too little by three 10

Now as the errors are alike, we have by the rule $\frac{36 \times 5 - 20 \times 3}{5 - 3} = 60$, the number of apples required.

(8) Suppose there were 6 Maids, which we should hope is not a very uncommon number to be found together in one place, then per question $6 + 12 = 18$, which is 8 above ten, therefore the error is 4 in excess.

Again, suppose there were 4 Maids, for we find we have guessed too many in our last supposition; then per question $4 + 8 = 12$, which is 2 above ten, therefore the error is 4 in defect; whence by the rule $\frac{6 \times 4 + 4 \times 4}{4 + 4} = 5$ the number req.

EXCHANGE.

EXCHANGE.

I. With FRANCE.

(¹) Here, as 54*d.* : 1*cr.* :: 180*l.* × 240 : $\frac{180 \times 240}{54} =$
800*cr.* the *Ans.*

(²) Here, as 1*cr.* : 54*d.* :: 800*cr.* then 54 × 800 =
43200*d.* which divided by 12 and 20, will give 180*l.* the *Ans.*

(³) Here, as 1*cr.* : 56*d.* :: 758*cr.* : 42448*d.* = 176*l.* 17*s.*
4*d.* the *Ans.*

(⁴) Here, as 56*d.* : 1*cr.* :: 42448*d.* = (176*l.* 17*s.* 4*d.*) :
758*cr.* the *Ans.*

(⁵) Here, as 720 deniers (or 1*cr.*) : 54 $\frac{1}{2}$ *d.* :: 522211 de-
niers (or 725*cr.* 17*sols.* 7*den.*) : $\frac{522211 \times 54\frac{1}{2}}{720} = 39528\frac{1}{2}$ *d.* =
164*l.* 14*s.* 0 $\frac{1}{2}$ *d.* the *Ans.*

(⁶) Here, as 54 $\frac{1}{2}$ *d.* : 1*cr.* :: 164*l.* 14*s.* 0 $\frac{1}{2}$ *d.* (or 39528 $\frac{1}{2}$ *d.*)
: $\frac{39528\frac{1}{2}}{54\frac{1}{2}} = 725$ *cr.* 17*sols.* 7*den.* the *Ans.*

II. With SPAIN.

(⁷) Here, as 1*peso.* : 56*d.* :: 2547*peso.* : 2547 × 56 =
142632*d.* = 594*l.* 6*s.* the *Ans.*

(⁸) Here as 56*d.* : 1*peso.* :: 594*l.* 6*s.* : $\frac{596*l.* 6*s.* \times 20 \times 12}{56} =$
2547*peso.* the *Ans.*

(⁹) Here, as 57 $\frac{1}{2}$ *d.* : 1*peso.* :: 600000*d.* (or 2500*l.*) :
 $\frac{600000 \times 4}{57\frac{1}{2} \times 4} = 10434$ *peso.* 6*rials.* 8 $\frac{2}{3}$ *mar.* the *Ans.*

III. With ITALY.

(¹⁰) Here, as 1 *dol.* : 53*d.* :: 976 *dol.* : $976 \times 53 = 51728d.$
 $= 215l. 10s. 8d.$ the *Anf.*

(¹¹) Here, as 53*d.* : 1 *dol.* :: 51728*d.* $= (215l. 10s. 8d.)$
 $: \frac{51728}{53} = 976 \text{ dol. the } Anf.$

(¹²) Here, as 1 *duc.* : 54*d.* :: 250 *duc.* : $250 \times 54 = 13500d.$
 $= 56l. 5s.$ the *Anf.*

(¹³) Here, as 54*d.* : 1 *duc.* :: 13500*d.* (or 56*l.* 5*s.*) :
 $\frac{13500}{54} = 250 \text{ ducatoons the } Anf.$

(¹⁴) Here, as 1 *duc.* : 53*d.* :: 275 *duc.* : $275 \times 53 =$
 $14575d.$ which divided by 12 and 20 will give 6*ol.* 14*s.*
 7*d.* the *Anf.*

(¹⁵) Here, as 53*d.* : 1 *duc.* :: 14575*d.* $= (6ol. 14s. 7d.)$
 $: \frac{14575}{53} = 275 \text{ duc. the } Anf.$

IV. With PORTUGAL.

(¹⁶) Here, as 1 *milrea* : 77*d.* :: 2750 *milreas* : $2750 \times$
 $77 = 211750d.$ which divided by 12 and 20 will give 882*l.*
 5*s.* 10*d.* the *Anf.*

(¹⁷) Here, as 77*d.* : 1 *mil.* :: 211750*d.* (or 882*l.* 5*s.* 10*d.*)
 $: \frac{211750}{77} = 2750 \text{ mil. the } Anf.$

(¹⁸) Here, as 1000 *reas.* : $65\frac{5}{8}d.$:: 4366183 *reas.* $=$
 $(4366 \text{ mil. } 183 \text{ reas.}) : \frac{4366183 \times 65\frac{5}{8}}{1000} = 286530\frac{3}{4}d. = 1193l.$
 17*s.* $6\frac{3}{4}d.$ the *Anf.*

(¹⁹) Here, as $65\frac{5}{8}d.$: 1 *mil.* :: $286530\frac{3}{4}d.$: $\frac{286530\frac{3}{4}}{65\frac{5}{8}} =$
 4366 *mil.* 183 *reas.* the *Anf.*

V. With

V. With HOLLAND, FLANDERS, AND GERMANY.

(²⁰) Here, as $1l. : 33\frac{1}{2}l. :: 754\frac{1}{2}l. : 1263l. 15s. 9d.$
Flemish, the *Ans.*

(²¹) Here, as $402d. = (33s. 6d.) : 1l. :: 303309d. =$
 $(1263l. 15s. 9d.) : \frac{303309}{402} = 754l. 10s. \text{ the } Ans.$

(²²) Here, as $240d. : 412\frac{1}{2} \text{ groats. (or } 34 \text{ schellings, } 4\frac{1}{2}$
 $\text{groats.)} :: 204630d. = (852l. 12s. 6d.) : \frac{204630 \times 412\frac{1}{2}}{240} =$
 $351707 \text{ groats, } 6\frac{1}{2} \text{ pennings,} = 8792 \text{ guilders, } 13 \text{ stivers, and}$
 $14\frac{1}{2} \text{ pennings, the } Ans.$

(²³) Here, as $34 \text{ schel. } 4\frac{1}{2} \text{ gro.} : 1l. :: 8792 \text{ guild. } 13 \text{ stiv.}$
 $14\frac{1}{2} \text{ pen.} : 852l. 12s. 6d. \text{ the } Ans. \text{ required.}$

NOTE. This answer being the reverse of the last we think
it quite unnecessary to set down the reduction, &c. The
same may be observed in many other instances.

How to convert Bank money into Current, and Current into
Bank and vice versa.

guild. cur. guild. b. guild. stiv. pen.

(²⁴) Here, as $104\frac{3}{8} : 100 :: 794 \text{ } 15 \text{ } 4$

20	20
2087 $\frac{4}{8}$	15895
16	16
33400	254324
	100

$(33400) \underline{25432400} (761 \text{ guild. and } 9 \text{ stivers.})$

(²⁵) Here, as $100 \text{ guild. b.} : 104\frac{3}{8} \text{ guild. cur.} :: 761 \text{ guild.}$
 $9 \text{ stiv.} : 794 \text{ guild. } 15 \text{ stiv. } 4 \text{ pen. the } Ans.$

VI. With

VI. With IRELAND.

(26) Here, as 110l. : 110l. : : 575l. 15s. :

$$\frac{575l. 15s. \times 110}{110} = 633l. 6s. 6d. \text{ Ans.}$$

(27) Here, as 110l. : 110l. : : 633l. 6s. 6d. :

$$\frac{633l. 6s. 6d. \times 110}{110} = 575l. 15s. \text{ the Ans.}$$

COMPARISON OF WEIGHTS AND MEASURES.

(1) Here, as 65 f. cr. : 50 du. p. : : 350 f. cr. : $\frac{350 \times 50}{65} =$
 269 $\frac{1}{3}$ Dutch pence, the Ans.

(2) Here, as 12 yd. l. : 8 e. p. : : 64 yd. l. : $\frac{64 \times 8}{12} =$
 42 $\frac{2}{3}$ e. p. the Ans.

(3) Here, as 28 lb. am. : 30 lb. l. : : 350 lb. am. : $\frac{350 \times 30}{28} =$
 375 lb. l. the Ans.

(4) Here, as 95 lb. f. : 106 lb. e. : : 275 lb. f. : $\frac{275 \times 106}{95} =$
 306 $\frac{80}{95}$ lb. e. the Ans.

CONJOINED PROPORTION.

lb. lb.

(1) 20 London = 23 Antwerp.

155 Antw. = 180 Leghorn.

72 Legh.

Then by the rule $\frac{20 \times 155 \times 72}{23 \times 180} = \frac{223200}{4140} = 53 \frac{37}{14} \text{ lb. the Ans.}$

(2) 12

lb. lb.
(2) 12 London = 10 Amsterdam.
100 Anst. = 120 Tholouse.
40 Thoul.

Then by the rule $\frac{12 \times 100 \times 40}{10 \times 120} = 4 \times 10 = 40 \text{ lb. the Ans.}$

(3) 140 bra. Venice = 156 bra. Leghorn.
7 bra. Legh. = 4 ells English.
16 ells Eng.

Then by the rule $\frac{140 \times 7 \times 16}{156 \times 4} = \frac{140 \times 7 \times 4}{156} = 25 \frac{20}{156} \text{ bra. the Ans.}$

lb. lb.
(4) 40 London = 36 Amsterdam.
90 Amst. = 116 Dantzick.
130 Lond.

Then by the rule $\frac{40 \times 90 \times 130}{36 \times 116} = 112 \frac{288}{4176} \text{ lb. the Ans.}$

lb. lb.
(5) 12 London = 10 Amsterdam.
100 Amst. = 120 Thoulouse.
How many lbs. Thoul. = 40 London.

Found thus,

$\frac{10 + 120 + 40}{12 + 100} = 10 \times 4 = 40 \text{ lb. the Ans.}$

lb. lb.
(6) 40 London = 36 Amsterdam.
90 Amst. = 116 Dantzick.
How many lbs. Dantz. = 122 London.

Found thus,

$\frac{36 + 116 + 122}{40 + 90} = 141 \frac{1872}{1600} \text{ lb. the Ans.}$

ARITHMETICAL PROGRESSION.

CASE I.

- (7) Here, $1+12=13$ the sum of the two extremes,
and $12=$ to the number of terms.

$$\text{then } 2 \overline{)156}$$

$\underline{78}$ to the number of strokes required.

This question may be otherwise solved by adding the same series to itself, with the terms in an inverted order, thus,

The given series.

$$1+2+3+4+5+6+7+8+9+10+11+12$$

The same inverted.

$$12+11+10+9+8+7+6+5+4+3+2+1$$

$$13+13+13+13+13+13+13+13+13+13+13+13$$

sum $= 13 \times 12 = 156$, the half of which is 78, the sum of the series as before.—This curious property in numbers is of considerable use in many parts of mathematical and philosophical sciences.

- (2) $2+10 \times 17 \div 2 = 102\frac{1}{2} = 5\frac{1}{2}$ the sum of the series, or amount required.

- (3) In this question $200+2=202$ the sum of the two extremes and 100 the number of all the terms

$$\text{then } 2 \overline{)20200}$$

gives 10100 yards = 5 miles and 1300 yards, the distance the man runs that takes up the eggs.

CASE II.

- (4) Here $\frac{32-4}{8-1}=4$ the common difference required.

- (5) First $\frac{58-3}{12-1}=5$ miles, the daily increase; then $58+3 \times 16 \div 2 = 366$ miles, the distance of the place from London.

CASE

CASE III.

(6) Here by the rule $\frac{58-3}{5} + 1 = 12$, the number of days he travelled.

(7) Here by the rule $\frac{32-4}{4} + 1 = 8$ the number of sons the man had.

CASE IV.

(8) Here $46 - \overline{10 - 1} \times 4 = 10$ miles, the first day's journey.

(9) Here $46 - \overline{8 - 1} \times 6 = 4$, the number required.

CASE V.

(10) Here by the rule $\frac{360}{32} = 30$, then $30 - \frac{4 \times 12 - 1}{2} = 8\%$ the first payment.

CASE VI.

(11) Here $20 \times 8 - 8 = 152$, then $152 + 6 = 158$ the last number required.

NOTE. It may be here observed, that in the series of odd numbers, (beginning with unity) as 1, 3, 5, 7, 9, 11, &c. The sum of any number of terms will be equal to the square of the number of terms given.

EXAMPLES.

The sum of five terms, to wit, 1, 3, 5, 7, and 9, is $5 \times 5 = 25$. The sum of seven terms, or 1, 3, 5, 7, 9, 11, and 13, is $7 \times 7 = 49$.

GEOMETRICAL PROGRESSION.

CASE I.

(1) First $\begin{Bmatrix} 0 & 1 & 2 & 3 & 4 \\ 1 & 2 & 4 & 8 & 16 \end{Bmatrix}$ exponents or indices.Then by the rule $\begin{Bmatrix} 4+4=8\text{th term.} \\ 16 \times 16 = 256 \end{Bmatrix}$

Mult. by 8 = 3d term.

gives $2048 = 11$ which is here tobe accounted the 12th, and last term, therefore $\frac{2048}{4 \times 12 \times 20} =$
2l. 2s. 8d. the *Ans.*(2) First $\begin{Bmatrix} 0 & 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 4 & 8 & 16 & 32 \end{Bmatrix}$ exponents.Then $\begin{Bmatrix} 5+5=10 \\ 32 \times 32 = 1024 \end{Bmatrix}$ and $\begin{Bmatrix} 10+10=20 \\ 1024 \times 1024 = 1048576 \end{Bmatrix}$

Lastly 1048576

x ed by 4 = 2

gives 4194304 = the number of farthings = 4369l. 1s. 4d.
the *Ans.*

CASE II.

(3) First $\begin{Bmatrix} 0 & 1 & 2 & 3 \\ 20 & 60 & 180 & 540 \end{Bmatrix}$ exponents.Then $\frac{540 \times 540}{20} = 14580$, and $\frac{14580 \times 60}{20} = 43700l.$ *Ans.*(4) First $\begin{Bmatrix} 0 & 1 & 2 & 3 & 4 & 5 \\ 50 & 100 & 200 & 400 & 800 & 1600 \end{Bmatrix}$ exponents.Then is $\frac{1600 \times 800}{50} = 25600l.$ the *Ans.* required.

CASE

CASE III.

(5) First $\begin{cases} 0 & 1 & 2 & 3 & 4 \text{ exponents.} \\ 1 & 4 & 16 & 64 & 256 \end{cases}$ farthings in \div

Then $256 \times 256 = 65536$, and $65536 \times 64 = 4194304$ the last term.

Again $\frac{4194304 - 1}{4 - 1} + 4194304 = 5592405$ farthings = 5825/.

8s. $5\frac{1}{4}$ d. the amount of his wages.

(6) First $\begin{cases} 0 & 1 & 2 & 3 & 4 & 5 \text{ exponents.} \\ 1 & 3 & 9 & 27 & 81 & 243 \end{cases}$ farthings in \div

Then $243 \times 243 = 59049 = 10$ term.

\times ed by $\frac{59049}{1}$

gives $3486784401 = 20$ term.

\times ed again by $\frac{177147}{1} = 11$ do.

gives $617673396283947 = 31$ do. which must here be accounted the 32d and last term, because the first term in the series is 1, which does neither multiply nor divide, therefore,

$\frac{617673396283947 - 1}{3 - 1} + 617673396283947 =$

926510094425920 farthings = 565114681693/ 13s. 4d. the Ans.

(7) First $\begin{cases} 0 & 1 & 2 & 3 & 4 & 5 \text{ exponents.} \\ 1 & 2 & 4 & 8 & 16 & 32 \end{cases}$ shillings in \div

Then $32 \times 16 \times 4 = 2048$ the eleventh term, which must here be accounted the last, and $\frac{2048 - 1}{2 - 1} + 2048 = 4095 = 204/ 15s$ the Ans.

(8) First $\begin{cases} 0 & 1 & 2 & 3 & 4 & 5 \text{ exponents.} \\ 2 & 6 & 18 & 54 & 162 & 486 \end{cases}$ pins in \div

Then $\frac{486 \times 486}{2} = 118098$, and $\frac{118098 \times 118098}{2} =$

6973568802 , also $\frac{6973568802 \times 6}{2} = 20920706406$, which

must be accounted the last term, hence $\frac{20920706406 - 2}{2} +$

$20920706406 = 31381059608$, the whole number of pins, M which

which at 100 for a farthing, gives 313810596 farthings = 326886*l.* *or.* 9*d.* what the lace was sold for. Again, $22 \times 7 = 154$ *l.* what was given for the lace; then 326886*l.* *or.* 9*d.* - 154*l.* = 326732*l.* *or.* 9*d.* the gain required.

NOTE. As our author has not taken any notice of decreasing geometrical series, by which many curious and pleasing questions may be solved, we shall therefore in this place give the following rule for solving questions of that kind, with a few examples for elucidating the same.

RULE. Divide the square of the first or greatest term, by the difference between the said first term and the second term in the series, and the quotient is the sum of the infinite progression in finite terms.

EXAMPLES.

(¹) Required the sum of $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \&c.$ ad infinitum?

Solution $\frac{\frac{1}{2} \times \frac{1}{2}}{\frac{1}{2} - \frac{1}{4}} = \frac{\frac{1}{4}}{\frac{1}{4}} = 1$ the *Ans.* required.

(²) What is the sum of the infinite geometrical series 1, $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \&c.$

Solution $\frac{1 \times 1}{\frac{1}{2} - \frac{1}{4}} = 2$ the sum required.

(³) Suppose a man walk 20 miles the first day, 19 the second, $18\frac{1}{2}$ the third, &c. in the same geometrical decreasing progression, would he ever arrive at a city 500 miles distant from the place set out from, were it possible he could travel through an infinity of ages and never stop?

Solution $\frac{20 \times 20}{20 - 19} = 400$ miles, the utmost distance he could travel; so that he would never arrive at the place set out for; that a body should be continually approaching another, and yet never arrive at it, may seem strange to some, but nevertheless may be proved true from other principles than these.

PERMUTATION.

(¹) $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$ the number of changes, which divided by 10, gives 47900160 min. $= 91$ yrs. 3 w. 5 d. 6 h. the time required.

(²) Here $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 = 5040$ days, the time required.

PART II.

VULGAR FRACTIONS.

REDUCTION OF VULGAR FRACTIONS.

CASE I.

(¹) Here $2 \times 7 = 14$ } the new numerator for $\left\{ \begin{array}{l} \frac{2}{4} \\ \frac{4}{7} \end{array} \right.$
 $4 \times 4 = 16$ }
 $4 \times 7 = 28$ the common denominator.

Therefore the new equivalent fractions are $\frac{14}{28}$ and $\frac{16}{28}$ the answer.

(²) Here $1 \times 4 \times 8 = 32$ } the new numerator for $\left\{ \begin{array}{l} \frac{1}{2} \\ \frac{3}{4} \\ \frac{5}{8} \end{array} \right.$
 $3 \times 2 \times 8 = 48$ }
 $5 \times 2 \times 4 = 40$ }
 $2 \times 4 \times 8 = 64$ the common denominator.

Therefore the new equivalent fractions are $\frac{32}{64}$, $\frac{48}{64}$, and $\frac{40}{64}$ the answer.

(3) Here $7 \times 6 \times 10 \times 7 = 2940$
 $4 \times 8 \times 10 \times 7 = 2240$
 $9 \times 8 \times 6 \times 7 = 3024$
 $6 \times 8 \times 6 \times 10 = 2880$
 $8 \times 6 \times 10 \times 7 = 3360$ the common denominator.

} the new numerator for

$$\left\{ \begin{array}{l} 7 \\ 8 \\ 4 \\ 6 \\ 9 \\ 10 \\ 6 \\ 7 \end{array} \right.$$

Therefore the new equivalent fractions are $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{3024}{3360}$,
 and $\frac{2880}{3360}$, the answer.

(4) Here $6 \times 4 \times 7 \times 6 = 1008$
 $2 \times 10 \times 7 \times 6 = 840$
 $1 \times 10 \times 4 \times 6 = 240$
 $3 \times 10 \times 4 \times 7 = 840$
 $10 \times 4 \times 7 \times 6 = 1680$ the common denominator.

} the new numerator for

$$\left\{ \begin{array}{l} 6 \\ 10 \\ 2 \\ 4 \\ 1 \\ 7 \\ 3 \\ 6 \end{array} \right.$$

Therefore the new equivalent fractions are $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$,
 and $\frac{840}{1680}$, the answer.

(5) Here $4 \times 3 \times 7 \times 8 = 672$
 $2 \times 5 \times 7 \times 8 = 560$
 $3 \times 5 \times 3 \times 8 = 360$
 $1 \times 5 \times 3 \times 7 = 105$
 $5 \times 3 \times 7 \times 8 = 840$ the common denominator,

} the new numerator for

$$\left\{ \begin{array}{l} 4 \\ 5 \\ 2 \\ 3 \\ 3 \\ 7 \\ 1 \\ 8 \end{array} \right.$$

Therefore the new equivalent fractions are $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$,
 and $\frac{105}{840}$, the answer.

(6) Here $2 \times 9 \times 8 \times 5 = 720$
 $5 \times 6 \times 8 \times 5 = 1200$
 $2 \times 6 \times 9 \times 5 = 540$
 $3 \times 6 \times 9 \times 8 = 1296$
 $6 \times 9 \times 8 \times 5 = 2160$ the common denominator,

} the new numerator for

$$\left\{ \begin{array}{l} 2 \\ 5 \\ 6 \\ 2 \\ 8 \\ 3 \\ 3 \\ 5 \end{array} \right.$$

Therefore the new equivalent fractions are $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$,
 and $\frac{1296}{2160}$, the answer.

CASE II.

(7) $24) 32(1$

$\frac{24}{24}$

com. measure $8) 24(3$

$\frac{24}{24}$

Then $8) \frac{24}{32} (= \frac{3}{4})$, the answer required.

(8)
$$\begin{array}{r} 30 \overline{)125(4} \\ \underline{120} \\ 5 \end{array}$$
 Then $5 \overline{) \frac{30}{125}} (= \frac{6}{25}$, the answer req.
com. measure $\underline{30}$
..

(9)
$$\begin{array}{r} 208 \overline{)684(3} \\ \underline{624} \\ 60 \overline{)208(3} \\ \underline{180} \\ 28 \overline{)60(2} \\ \underline{56} \end{array}$$
 Then $4 \overline{) \frac{208}{684}} (= \frac{32}{171}$, the answer req.
com. measure $\underline{28}$
..

(10)
$$\begin{array}{r} 192 \overline{)576(3} \\ \underline{576} \end{array}$$
 Then $192 \overline{) \frac{192}{576}} (= \frac{1}{3}$ the answer req.
...

NOTE, Here the given numerator is the common measure required.

(11)
$$\begin{array}{r} 825 \overline{)960(1} \\ \underline{825} \\ 135 \overline{)825(6} \\ \underline{810} \end{array}$$
 Then $15 \overline{) \frac{825}{960}} (= \frac{55}{64}$, the answer req.
com. measure $\underline{135}$
..

(12)
$$\begin{array}{r} 5184 \overline{)6912(1} \\ \underline{5184} \\ 1728 \overline{)5184(3} \\ \underline{5184} \end{array}$$
 Then $1728 \overline{) \frac{5184}{6912}} (= \frac{3}{4}$ the Ans. req.
com. measure $\underline{1728}$
...

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CASE III.

$$\begin{array}{l|l} (13) \frac{18 \times 7 + 3}{7} = 1\frac{29}{7} \text{ the Ans.} & (16) \frac{13 \times 5 + 4}{5} = \frac{69}{5} \text{ Ans.} \\ (14) \frac{56 \times 22 + 13}{22} = 1\frac{245}{22} \text{ Ans.} & (17) \frac{27 \times 9 + 2}{9} = 2\frac{45}{9} \text{ Ans.} \\ (15) \frac{183 \times 21 + 5}{21} = 3\frac{343}{21} \text{ Ans.} & (18) \frac{514 \times 16 + 5}{16} = 514\frac{5}{16} \text{ Ans.} \end{array}$$

CASE IV.

$$\begin{array}{l|l} (19) 129 \div 7 = 18\frac{3}{7}, \text{ Ans.} & (21) 69 \div 5 = 13\frac{4}{5}, \text{ Ans.} \\ (20) 1245 \div 22 = 56\frac{13}{22}, \text{ Ans.} & (23) 245 \div 9 = 27\frac{2}{9}, \text{ Ans.} \\ (21) 3848 \div 21 = 183\frac{5}{21}, \text{ Ans.} & (24) 8229 \div 16 = 514\frac{5}{16}, \text{ Ans.} \end{array}$$

CASE V.

(25) Here $\frac{2 \times 3 \times 5}{3 \times 5 \times 8} = \frac{2}{8} = \frac{1}{4}$, the Ans. required.

(26) Here $\frac{5 \times 4 \times 11}{9 \times 7 \times 12} = \frac{5 \times 11}{9 \times 7 \times 3} = \frac{55}{189}$, the Ans. required.

(27) Here $\frac{11 \times 13 \times 21}{12 \times 14 \times 29} = \frac{11 \times 13}{4 \times 2 \times 29} = \frac{143}{232}$, the Ans. req.

(28) Here $\frac{3 \times 5 \times 9}{4 \times 6 \times 10} = \frac{3 \times 3}{4 \times 4} = \frac{9}{16}$, the Ans. required.

(29) Here $\frac{4 \times 6 \times 7}{5 \times 8 \times 9} = \frac{168}{360} = \frac{7}{15}$, the Ans. required.

(30) Here $\frac{2 \times 5 \times 8}{7 \times 9 \times 10} = \frac{80}{630} = \frac{8}{63}$, the Ans. required.

CASE

CASE VI.

$$\begin{array}{l} (31) \frac{7}{8 \times 12 \times 20} = \frac{7}{1920}, \text{ Ans.} \\ (32) \frac{1}{4 \times 12 \times 20} = \frac{1}{960}, \text{ Ans.} \end{array} \quad \left| \quad \begin{array}{l} (33) \frac{4}{5 \times 20 \times 12} = \frac{4}{1200}, \text{ Ans.} \\ (34) \frac{4}{7 \times 112} = \frac{4}{784}, \text{ Ans.} \end{array} \right.$$

CASE VII.

$$\begin{array}{l} (35) \frac{7 \times 20 \times 12}{1920} = \frac{1680}{1920} = \frac{7}{8}, \text{ Ans.} \\ (36) \frac{1 \times 20 \times 12}{960} = \frac{240}{960} = \frac{1}{4}, \text{ Ans.} \end{array} \quad \left| \quad \begin{array}{l} (37) \frac{4 \times 12 \times 20}{1200} = \frac{960}{1200} = \frac{4}{5}, \text{ Ans.} \\ (38) \frac{4 \times 4 \times 28}{784} = \frac{448}{784} = \frac{4}{7}, \text{ Ans.} \end{array} \right.$$

CASE VIII.

- (39) As 2 : 3 :: 12 : 18, then is $\frac{12}{3}$ the Ans.
 (40) As 5 : 7 :: 25 : 35, then is $\frac{25}{5}$ the Ans.
 (41) As 5 : 7 :: 47 : $65\frac{4}{5}$, then is $\frac{47}{65\frac{4}{5}}$ the Ans.

CASE IX.

- (42) As 3 : 2 :: 18 : 12, then is $\frac{12}{3}$ the Ans.
 (43) As 7 : 5 :: 35 : 25, then is $\frac{25}{5}$ the Ans.
 (44) As 7 : 5 :: 65 : 47, then is $\frac{47}{65\frac{4}{5}}$ the Ans.

CASE

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CASE X.

$$(45) \frac{36 \times 3 + 2}{48 \times 3} = \frac{110}{144} = \frac{55}{72}, \text{ the Ans. required.}$$

$$(46) \frac{23 \times 7 + 5}{38 \times 7} = \frac{166}{266} = \frac{83}{133}, \text{ the Ans. required.}$$

$$(47) \frac{47 \times 5}{65 \times 5 + 4} = \frac{235}{329} = \frac{5}{7}, \text{ the Ans. required.}$$

$$(48) \frac{19 \times 3}{44 \times 3 + 1} = \frac{57}{133} = \frac{3}{7}, \text{ the Ans. required.}$$

CASE XI.

$$(49) \frac{3 \times 20}{4} = 15s. \text{ Ans.}$$

$$(55) \frac{4 \times 8}{5} = 6 \text{ fur. } 16 \text{ po. Ans.}$$

$$(50) \frac{2 \times 12}{5} = 4\frac{3}{5}d. \text{ Ans.}$$

$$(56) \frac{5 \times 4}{8} = 2r. 20p. \text{ Ans.}$$

$$(51) \frac{4 \times 16}{7} = 9oz. 2\frac{2}{7}dr. \text{ Ans.}$$

$$(57) \frac{6 \times 63}{7} = 54 \text{ gals. Ans.}$$

$$(52) \frac{7 \times 112}{9} = 87\frac{1}{9}lb. = 3 \text{ qrs. } 3lb. 1oz. 12\frac{4}{9}dr. \text{ Ans.}$$

$$(58) \frac{3 \times 36}{9} = 12 \text{ gals. Ans.}$$

$$(53) \frac{3 \times 12}{5} = 7oz. 4dwt. \text{ Ans.}$$

$$(59) \frac{5 \times 36}{12} = 15 \text{ buff. Ans.}$$

$$(54) \frac{5 \times 5}{9} = 2 \text{ qrs. } 3\frac{1}{9}n. \text{ Ans.}$$

$$(60) \frac{3 \times 4}{5} = 2 \text{ wks. } 2d. 19\frac{1}{5}b.$$

CASE XII.

$$(61) 15 \div 20 = \frac{3}{4}, \text{ the Ans. required.}$$

$$(62) \frac{4 \times 4 + 3\frac{1}{2}}{12 + 4} = \frac{19 \times 5 + 1}{48 \times 5} = \frac{96}{240} = \frac{2}{5}, \text{ the answer required}$$

$$(63) \frac{9 \times 16 + 2\frac{2}{7}}{16 \times 16} = \frac{146 \times 7 + 2}{256 \times 7} = \frac{1024}{1792} = \frac{4}{7}, \text{ the answer req.}$$

$$(64) \frac{3 \times 28 + 3 \times 16 + 1 \times 16 + 12\frac{4}{9}}{1 \times 4 \times 28 \times 16 \times 16} = \frac{22300\frac{4}{9}}{28672} = \frac{22300 \times 9 + 4}{28672 \times 9} = \frac{200704}{258048} = \frac{7}{9}, \text{ the answer required.}$$

$$(65) \frac{7 \times 20 + 4}{12 \times 20} = \frac{144}{240} = \frac{3}{5}, \text{ the answer required.}$$

$$(66) \frac{2 \times 4 + 3\frac{1}{2}}{5 \times 4} = \frac{11\frac{1}{2}}{20} = \frac{11 \times 9 + 1}{20 \times 9} = \frac{100}{180} = \frac{5}{9}, \text{ the ans. req.}$$

$$(67) \frac{6 \times 40 + 16}{8 \times 40} = \frac{256}{320} = \frac{4}{5}, \text{ the answer required.}$$

$$(68) \frac{2 \times 40 + 20}{4 \times 40} = \frac{5}{8}, \text{ the answer required.}$$

$$(69) 54 \div 63 = \frac{6}{7}, \text{ the answer required.}$$

$$(70) 12 \div 36 = \frac{1}{3}, \text{ the answer required.}$$

$$(71) 15 \div 36 = \frac{5}{12}, \text{ the answer required.}$$

$$(72) \frac{2 \times 7 + 2 \times 24 + 19\frac{1}{2}}{4 \times 7 \times 24} = \frac{403\frac{1}{2}}{672} = \frac{403 \times 5 + 1}{672 \times 5} = \frac{2016}{3360} = \frac{3}{5},$$

the answer required.

ADDITION OF VULGAR FRACTIONS.

(1) The fractions being reduced to a common denominator, are $\frac{14}{21}$ and $\frac{15}{21}$, then $\frac{14+15}{21} = 1\frac{8}{21}$, the Ans.

(2) The

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(2) The given fractions being reduced as before, are $\frac{126}{168}$, $\frac{48}{168}$, and $\frac{140}{168}$, then $\frac{126+48+140}{168} = 1\frac{146}{168}$, *Ans.*

(3) The given fractions are equal to $\frac{3}{15} + 4\frac{5}{15} + \frac{6}{15} = 4 + \frac{3+5+6}{15} = 4\frac{14}{15}$, the *Ans.*

(4) The given fractions are equal to $7\frac{10}{15} + \frac{6}{15} = 7 + \frac{10+6}{15} = 8\frac{1}{3}$, the *Ans.*

(5) The given fractions are equal to $\frac{2}{7} + \frac{6}{12} = \frac{24}{84} + \frac{42}{84} = \frac{66}{84} = \frac{11}{14}$, the *Ans.*

(6) The given fractions are equal to $5\frac{16}{24} + 6\frac{21}{24} + 4\frac{12}{24} = 5 + 6 + 4 + \frac{16+21+12}{24} = 17\frac{1}{24}$, the *Ans.*

(7) $\frac{3}{4}$ of a pound = 15 0
 $\frac{5}{6}$ of a shilling = 0 10
 Sum 15 10

(10) $\frac{4}{5}$ of a ton = 16 0 0
 $\frac{5}{6}$ of a lb. = 0 13 $\frac{5}{3}$
 Sum 16 13 $\frac{5}{3}$

(8) $\frac{1}{2}$ of a penny = 0 0 $\frac{1}{2}$
 $\frac{2}{3}$ of a pound = 13 4
 Sum 13 4 $\frac{1}{2}$

(11) $\frac{2}{3}$ of a chald. = 24 0
 $\frac{3}{4}$ of a bush. = 0 3
 Sum 24 3

(9) $\frac{3}{4}$ of a lb. = 9 0 0
 $\frac{1}{6}$ of an oz. = 0 3 8
 Sum 9 3 8

(12) $\frac{1}{6}$ of a yard = 6 0
 $\frac{2}{3}$ of an inch = 0 2
 Sum 6 2

SUBTRACTION OF VULGAR FRACTIONS.

(1) $\frac{3 \times 7}{4 \times 7} - \frac{5 \times 4}{4 \times 7} = \frac{21-20}{28} = \frac{1}{28}$ the *Ans.* required.

(2) $\frac{2}{3}$

Subtraction of Vulgar Fractions. 143

(2) $\frac{3}{5}$ of $\frac{5}{8} = \frac{3 \times 5}{5 \times 8} = \frac{3}{8} = \frac{9}{24}$, and $\frac{5}{6} = \frac{20}{24}$; whence $\frac{20}{24} - \frac{9}{24} = \frac{11}{24}$ the *Ans.*

(3) $5\frac{2}{3} = \frac{17}{3} = \frac{170}{30}$ and $\frac{9}{10} = \frac{27}{30}$; whence $\frac{170}{30} - \frac{27}{30} = \frac{143}{30}$ the *Ans.*

(4) The fractions being reduced to a common denominator are $\frac{190}{235}$ and $\frac{141}{235}$; whence $\frac{190}{235} - \frac{141}{235} = \frac{49}{235}$ the *Ans.*

(5) First $\frac{1}{7}$ of $\frac{2}{3}$ is $\frac{2}{21}$, and the fractions being now reduced to a common denominator are $\frac{399}{420}$ and $\frac{40}{420}$, then $\frac{399}{420} - \frac{40}{420} = \frac{359}{420}$ the *Ans.*

(6) $\frac{2}{3}$ of $\frac{3}{4}$ is $\frac{2 \times 3}{3 \times 4} = \frac{2}{4}$, and $64\frac{1}{4} = \frac{257}{4}$, whence $\frac{257}{4} - \frac{2}{4} = \frac{255}{4} = 63\frac{3}{4}$ the *Ans.*

<p>(7) $\frac{3}{4}$ of a pound = 15 0 $\frac{3}{4}$ of a shilling = 0 9 diff. 14 3</p>	<p>(10) $\frac{1}{5}$ of a t. = 16 0 0 0 $\frac{5}{6}$ of a lb. = 0 0 0 13 $\frac{1}{3}$ diff. 15 3 27 2 $\frac{10}{3}$</p>
---	---

<p>(8) $\frac{2}{3}$ of a shilling = 8 $\frac{1}{2}$ of a penny = 0 $\frac{1}{2}$ diff. 7 $\frac{1}{2}$</p>	<p>(11) $\frac{2}{3}$ of a chald. = 24 0 $\frac{3}{4}$ of a bush. = 0 3 diff. 23 1</p>
---	--

<p>(9) $\frac{3}{4}$ of a lb. = 9 0 0 $\frac{1}{6}$ of an oz. = 0 3 8 diff. 8 16 16</p>	<p>(12) $\frac{1}{6}$ of a yard = 6 0 $\frac{2}{3}$ of an inch = 0 2 diff. 5 1</p>
---	--

MULTI-

MULTIPLICATION OF VULGAR FRACTIONS.

$$(1) \frac{3 \times 3}{4 \times 5} = \frac{9}{20} \text{ the Ans.}$$

$$(2) \frac{7 \times 2}{9 \times 3} = \frac{14}{27} \text{ the Ans.}$$

$$(3) \frac{243 \times 83}{5 \times 6} = \frac{20169}{30} = 672 \frac{9}{10} \text{ the Ans.}$$

$$(4) \frac{4306 \times 129}{10 \times 7} = \frac{555474}{70} = 7935 \frac{24}{70} \text{ the Ans.}$$

$$(5) \frac{16 \times 3 \times 5 \times 4}{21 \times 4 \times 7 \times 5} = \frac{16}{7 \times 7} = \frac{16}{49} \text{ the Ans.}$$

$$(6) \frac{9 \times 2 \times 3 \times 5}{10 \times 3 \times 4 \times 6} = \frac{3}{2 \times 4} = \frac{3}{8} \text{ the Ans.}$$

$$(7) \frac{3 \times 2 \times 2 \times 1}{4 \times 3 \times 3 \times 3} = \frac{1}{3 \times 3} = \frac{1}{9} \text{ the Ans.}$$

$$(8) \frac{1 \times 3 \times 5}{4 \times 8 \times 7} = \frac{15}{224} \text{ the Ans.}$$

$$(9) \frac{41 \times 5}{7 \times 6} = \frac{205}{42} = 4 \frac{37}{42} \text{ Ans.}$$

$$(10) \frac{24 \times 2}{1 \times 3} = 8 \times 2 = 16, \text{ Ans.}$$

$$(11) \frac{3 \times 9 \times 7}{4 \times 1 \times 8} = \frac{189}{32} = 5 \frac{29}{32}, \text{ the Ans.}$$

$$(12) \frac{19 \times 2}{2 \times 6} = \frac{19}{6} = 3 \frac{1}{6}, \text{ Ans.}$$

DIVISION OF VULGAR FRACTIONS.

$$(1) \frac{9}{20} \div \frac{3}{5} = \frac{9 \div 3}{20 \div 5} = \frac{3}{4}, \text{ the answer required.}$$

$$(2) \frac{14}{27} \div \frac{2}{3} = \frac{14 \div 2}{27 \div 3} = \frac{7}{9}, \text{ the answer required.}$$

$$(3) \frac{20169}{30} \div \frac{83}{6} = \frac{20169 \times 6}{83 \times 30} = \frac{121014}{2490} = 48 \frac{2}{3}, \text{ the answer.}$$

$$(4) \frac{555474}{70} \div \frac{129}{7} = \frac{555474 \times 7}{129 \times 70} = \frac{555474}{129 \times 10} = 430 \frac{3}{5}, \text{ Ans.}$$

$$(5) \frac{3}{4}$$

$$(5) \frac{1}{8} \div \frac{2 \times 3 \times 5}{3 \times 4 \times 6} = \frac{3 \times 3 \times 4 \times 6}{2 \times 3 \times 5 \times 8} = \frac{9}{10}, \text{ the answer.}$$

$$(6) \frac{32}{3} \div \frac{5 \times 3}{7 \times 4} = \frac{32 \times 7 \times 4}{3 \times 5 \times 3} = 19\frac{4}{5}, \text{ the answer.}$$

$$(7) \frac{1 \times 2}{2 \times 3} \div \frac{2 \times 3}{3 \times 4} = \frac{1 \times 3 \times 2 \times 4}{2 \times 2 \times 3 \times 3} = \frac{1 \times 4}{2 \times 3} = \frac{2}{3}, \text{ the answer.}$$

$$(8) \frac{110}{12} \div \frac{1 \times 7}{2} = \frac{110 \times 2}{12 \times 7} = \frac{220}{84} = 2\frac{11}{21}, \text{ the answer.}$$

$$(9) \frac{9}{16} \div \frac{9}{2} = \frac{9 \div 9}{16 \div 2} = \frac{1}{8}, \text{ the answer.}$$

$$(10) \frac{4 \times 4}{4 \times 6} = \frac{4}{6} = \frac{2}{3}, \text{ the answer.}$$

$$(11) \frac{52052}{10} \div \frac{4 \times 91}{5 \times 1} = \frac{52052 \times 5}{10 \times 4 \times 91} = \frac{52052}{728} = 71\frac{2}{13}, \text{ the ans.}$$

$$(12) \frac{19}{6} \div \frac{19}{2} = \frac{19 \div 19}{6 \div 2} = \frac{1}{3}, \text{ the answer.}$$

THE SINGLE RULE OF THREE DIRECT
IN VULGAR FRACTIONS.

$$(1) \text{ As } \frac{3}{4} \text{ yd.} : \frac{5}{8} \text{ l.} :: \frac{9}{16} \text{ yd.} : \frac{4 \times 5 \times 9}{3 \times 8 \times 10} = \frac{3}{4} \text{ l.} = 15 \text{ s. } \text{Ans.}$$

$$(2) \text{ As } \frac{5}{6} \text{ yd.} : \frac{2}{3} \text{ l.} :: \frac{11}{12} \text{ yd.} : \frac{6 \times 2 \times 11}{5 \times 3 \times 12} = \frac{11}{5 \times 3} = \frac{11}{15} \text{ l.} = 14 \text{ s. } 8 \text{ d. } \text{Ans.}$$

$$(3) \text{ As } \frac{3}{4} \text{ yd.} : \frac{29}{4} \text{ s.} :: \frac{31}{3} \text{ yd.} : \frac{4 \times 29 \times 31}{3 \times 4 \times 3} = \frac{29 \times 31}{3 \times 3} = \frac{299}{3} \text{ s.} = 4 \text{ l. } 19 \text{ s. } 10\frac{1}{2} \text{ d. } - \frac{2}{3}, \text{ Ans.}$$

N

(*) A

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$$(4) \text{ As } \frac{2}{4} \text{ s.} : \frac{7}{8} \text{ lb.} :: \frac{8}{9} \text{ s.} : \frac{4 \times 7 \times 8}{3 \times 8 \times 9} = \frac{7 \times 4}{3 \times 9} = \frac{28}{27} \text{ lb.} = 1 \frac{1}{27} \text{ lb. Ans.}$$

$$(5) \text{ As } \frac{3}{5} \text{ ell.} : \frac{1}{3} \text{ l.} :: \frac{38}{3} \text{ ell.} : \frac{1 \times 5 \times 38}{3 \times 3 \times 3} = 7 \text{ l. or. } 8 \frac{1}{4} \text{ d.} - \frac{43}{27} \text{ Ans.}$$

$$(6) \text{ As } \frac{25}{2} \text{ yds.} : 15 \frac{3}{4} \text{ s.} :: 12 \frac{3}{4} \text{ yds.} : \frac{193 \times 63 \times 2}{25 \times 4 \times 4} = 3 \text{ l. or. } 9 \frac{1}{2} \text{ d.} - \frac{36}{100} \text{ Ans.}$$

$$(7) \text{ As } \frac{9}{10} \text{ cwt.} : \frac{28}{1} \text{ s.} :: \frac{15}{2} \text{ cwt.} : \frac{284 \times 15 \times 10}{9 \times 2} = \frac{284 \times 25}{3} = 118 \text{ l. } 6 \text{ s. } 8 \text{ d. Ans.}$$

$$(8) \text{ As } \frac{3}{1} \text{ yd.} : \frac{14}{5} \text{ l.} :: 7 \frac{2}{7} \text{ yds.} : \frac{1 \times 14 \times 72}{3 \times 5 \times 7} = \frac{2 \times 3 \times 8}{5} = \frac{48}{5} = 9 \text{ l. } 12 \text{ s. Ans.}$$

$$(9) \text{ As } \frac{1}{7} \text{ qr.} : \frac{2}{3} \text{ l.} :: \frac{3}{1} \text{ qrs. (or } \frac{3}{5} \text{ of ell.)} : \frac{1 \times 2 \times 3}{3} = 2 \text{ l. Ans.}$$

$$(10) \text{ As } \frac{1}{1} \text{ lb.} : 1 \frac{1}{4} \text{ l.} :: 3 \frac{67}{10} \text{ lb.} : \frac{1 \times 367 \times 5}{1 \times 4 \times 10} = \frac{367}{8} = 45 \text{ l. } 17 \text{ s. } 6 \text{ d. Ans.}$$

$$(11) \text{ As } \frac{1}{1} \text{ yd.} : 12 \frac{5}{8} \text{ s.} :: \frac{192 \times 4}{7} \text{ yds.} : \frac{1 \times 125 \times 192 \times 4}{8 \times 7} = \frac{24000}{14} = 85 \text{ l. } 14 \text{ s. } 3 \frac{1}{4} \text{ d.} - \frac{10}{14} \text{ Ans.}$$

$$(12) \text{ As } \frac{1}{1} \text{ ell.} : 2 \frac{9}{4} \text{ d.} :: \frac{7 \times 195}{2 \times 8} \text{ ells.} : \frac{1 \times 291 \times 7 \times 195}{1 \times 4 \times 2 \times 8} = 25 \text{ l. } 17 \text{ s. } 2 \frac{1}{4} \text{ d.} - \frac{15}{10} \text{ Ans.}$$

THE SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

$$(1) \text{ As } \frac{97}{4} \text{ da.} : \frac{48}{1} \text{ m.} :: 12 \frac{1}{1} \text{ da.} : \frac{1 \times 48 \times 97}{1 \times 4 \times 192} = \frac{12 \times 97}{192} = 6 \text{ m. } \frac{12}{192} \text{ Ans.}$$

(2) As

(2) As $\frac{1}{2}$ cwt. : $\frac{3}{4}$ m. :: $\frac{1}{2}$ cwt. : $\frac{1 \times 581 \times 2}{1 \times 4 \times 13} = \frac{581}{2 \times 13} =$
 22 m. $\frac{9}{16}$ Ans.

(3) As $\frac{6}{5}$ yds. : $\frac{13}{4}$ yds. :: $\frac{4}{5}$ yds. : $\frac{6 \times 13 \times 5}{5 \times 4 \times 4} = \frac{6 \times 13}{4 \times 4} =$
 $\frac{78}{16} = 4\frac{7}{8}$ yds. Ans.

(4) As $\frac{3}{4}$ m. : $\frac{9}{2}$ br. :: $\frac{10}{2}$ m. : $\frac{3 \times 9 \times 1}{1 \times 2 \times 10} = \frac{27}{20} = 1$ br. $\frac{7}{2}$ Ans.

(5) As $\frac{7}{1}$ oz. : $\frac{11}{2}$ s. :: $\frac{5}{2}$ oz. : $\frac{7 \times 11 \times 2}{1 \times 2 \times 5} = \frac{7 \times 11}{5} =$
 15 s. 4 d. $\frac{4}{5}$ Ans.

(6) As $\frac{3}{2}$ yds. : $\frac{15}{2}$ yds. :: $\frac{3}{4}$ yds. : $\frac{3 \times 15 \times 4}{2 \times 2 \times 3} = 15$ yds. Ans.

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

(1) First, as $\frac{12}{1}$ qrs. : $\frac{21}{16}$ l. : $\frac{63}{2}$ qrs. : $\frac{1 \times 21 \times 63}{12 \times 10 \times 2}$ l. then
 as $\frac{150}{1}$ m. : $\frac{1 \times 21 \times 63}{12 \times 10 \times 2}$ l. :: $\frac{50}{1}$ m. : $\frac{1 \times 1 \times 21 \times 63 \times 50}{1 \times 12 \times 10 \times 2 \times 150} =$
 $\frac{7 \times 3 \times 7}{4 \times 10 \times 2} = \frac{147}{80} = 1$ l. 16 s. 9 d. Ans.

(2) First as $\frac{6}{1}$ l. : $\frac{100}{1}$ s. :: $\frac{27}{8}$ l. : $\frac{1 \times 100 \times 27}{1 \times 6 \times 8} = \frac{25 \times 9}{2 \times 2}$
 then, as $\frac{25}{1}$ m. : $\frac{25 \times 9}{2 \times 2}$ l. :: $\frac{9}{1}$ m. : $\frac{12 \times 1 \times 25 \times 9}{2 \times 2 \times 1 \times 9} = 3 \times 25$
 = 75 l. Ans.

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(3) First as $\frac{1}{1}d. : \frac{97}{9}l. :: \frac{30}{1}d. : \frac{1 \times 97 \times 30}{18 \times 9 \times 1} = \frac{97 \times 10}{18 \times 3}$
 then, as $\frac{9}{1}flu. : \frac{97 \times 10}{18 \times 3}l. :: \frac{20}{1}flu. : \frac{97 \times 10 \times 1 \times 20}{9 \times 18 \times 3 \times 1} =$
 $39l. 18s. 4d. \frac{60}{243}, \text{Ans.}$

(4) First as $\frac{1}{1}d. : \frac{37}{8}s. :: \frac{21}{2}d. : \frac{1 \times 37 \times 21}{8 \times 2 \times 1}s. \text{ then,}$
 as $\frac{2}{1}per. : \frac{1 \times 37 \times 21}{8 \times 2 \times 1}s. :: \frac{4}{1}per. : \frac{1 \times 1 \times 37 \times 21 \times 4}{2 \times 8 \times 2 \times 1 \times 1} =$
 $\frac{37 \times 21}{8} = 4l. 17s. 1\frac{1}{2}d. \text{Ans.}$

(5) First, as $\frac{1}{1}l. : \frac{3}{1}m. :: \frac{40}{1}l. : \frac{50 \times 5 \times 3}{1 \times 1 \times 40} = \frac{5 \times 5 \times 3}{1 \times 4 \times 1}m.$
 then, as $\frac{3\frac{3}{4}}{1}l. : \frac{5 \times 5 \times 3}{1 \times 4 \times 1}m. :: \frac{1\frac{1}{2}}{1}l. : \frac{144 \times 5 \times 5 \times 3 \times 13}{325 \times 1 \times 4 \times 1 \times 12} =$
 $9m. \text{Ans.}$

(6) First, as $\frac{20}{1}m. : \frac{60}{1}cwt. :: \frac{30}{1}m. : \frac{20 \times 1 \times 60}{1 \times 30 \times 1} =$
 $\frac{20 \times 2}{1}cwt. \text{ then, as } \frac{29}{2}l. : \frac{20 \times 2}{1}cwt. :: \frac{87}{1}l. : \frac{2 \times 20 \times 2 \times 87}{29 \times 1 \times 16} = 15cwt. \text{Ans.}$

PART

PART III.

DECIMAL FRACTIONS.

ADDITION OF DECIMALS.

(¹)	72,5	(²)	30,07	(³)	3,5
	32,071		2,0071		47,25
	2,1574		59,4		927,01
	371,4		3207,1		2,0073
	2,75				1,5
	480,8784	Sum	3298,5771	Sum	981,2673
Sum	961,7568				

(⁴)	52,75	(⁵)	3275,	(⁶)	27,5
	47,21		27,514		52,
	724,		1,005		3,2075
	31,452		725,		0,5741
	3075		7,32		2720,
Sum	855,7195	Sum	4035,839	Sum	2803,2816

SUBTRACTION OF DECIMALS.

(¹)	,2754	(²)	2,37	(³)	271,	(⁴)	270,2
	,2371		1,76		215,7		76,4075
Diff.	,0383		0,61		55,3		193,7925
(⁵)	571,	(⁶)	625,	(⁷)	23,415	(⁸)	,107
	54,72		76,91		3742		,0007
Diff.	516,28		548,09		23,0408		,1063

MULTIPLICATION OF DECIMALS.

$$\begin{array}{r}
 \text{(1)} \quad .2365 \\
 \quad .2435 \\
 \hline
 \text{Prod. } .05758775 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(2)} \quad 2.071 \\
 \quad .227 \\
 \hline
 4.70117 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(3)} \quad 27.15 \\
 \quad 25.3 \\
 \hline
 686.895 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(4)} \quad 79347 \\
 \quad 23.15 \\
 \hline
 \text{Prod. } 1836883.05 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(5)} \quad 17105 \\
 \quad .3257 \\
 \hline
 5571.0985 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(6)} \quad 17105 \\
 \quad .0237 \\
 \hline
 405.3885 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(7)} \quad 7.70071 \\
 \quad 27.35 \\
 \hline
 \text{Prod. } 210.6144185 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(8)} \quad 5.721 \\
 \quad .0075 \\
 \hline
 .0429075 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(9)} \quad 2.07 \\
 \quad .007 \\
 \hline
 .01449 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(10)} \quad 20.15 \\
 \quad .2705 \\
 \hline
 \text{Prod. } 5.450575 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(11)} \quad .907 \\
 \quad .0025 \\
 \hline
 .0022675 \\
 \hline
 \end{array}$$

CONTRACTED MULTIPLICATION OF DECIMALS.

$$\begin{array}{r}
 \text{(12)} \quad 384.672158 \\
 \quad 5438.63 \\
 \hline
 115401647 \\
 23080329 \\
 \hline
 3077377 \\
 115402 \\
 2115387 \\
 1923 \\
 \hline
 \text{Prod. } 14169.2065 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 \text{(13)} \quad 3.141592 \\
 8347.25 \\
 \hline
 1570796 \\
 62831 \\
 \hline
 21991 \\
 1257 \\
 94 \\
 25 \\
 \hline
 1656994 \\
 \hline
 \end{array}$$

$$\text{(14)} \quad 2.38645$$

Division of Decimals.

150

$$\begin{array}{r}
 (14) \ 2,38645 \\
 \underline{5712,8} \\
 190916 \\
 \underline{4773} \\
 2391 \\
 \underline{167} \\
 12
 \end{array}$$

Prod. 19,6107

$$\begin{array}{r}
 (15) \ 375,13758 \\
 \underline{4237,61} \\
 37514 \\
 \underline{22508} \\
 2623 \\
 \underline{1125} \\
 8
 \end{array}$$

6276,9

$$\begin{array}{r}
 (16) \ 375,13758 \\
 \underline{4237,61} \\
 37513758 \\
 \underline{22508255} \\
 2625963 \\
 \underline{112541} \\
 7503 \\
 \underline{1500}
 \end{array}$$

Prod. 6276,9520

$$\begin{array}{r}
 (17) \ 395,3756 \\
 \underline{24657,} \\
 2767629 \\
 \underline{197688} \\
 23722 \\
 \underline{1582} \\
 79
 \end{array}$$

299,0700

NOTE. We need not make use of any more figures in our multiplier than what stands even with our multiplicand to the left, as in example 15.

DIVISION OF DECIMALS.

(1) 6,321)8564,825(1354,9 Ans. (2) ,144)18,000(333,3 Ans.

$$\begin{array}{r}
 6321 \\
 \underline{22438} \\
 18963 \\
 \underline{34752} \\
 31605 \\
 \underline{31475} \\
 25284 \\
 \underline{61910} \\
 56889 \\
 \underline{5021}
 \end{array}$$

$$\begin{array}{r}
 432 \\
 \underline{480} \\
 432 \\
 \underline{480} \\
 432 \\
 \underline{480} \\
 432 \\
 \underline{480} \\
 =
 \end{array}$$

(3) 65)

(3) 65) 217.75 (3.35 *Ans.* (4) ,1045) 125.0000 (1196) *Ans.*

$$\begin{array}{r}
 195 \\
 \cdot 227 \\
 \hline
 195 \\
 \cdot 325 \\
 \hline
 325 \\
 \cdot 5 \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 1045 \\
 \cdot 2050001 \\
 \hline
 1045 \\
 10050 \\
 \hline
 9405 \\
 \cdot 6450 \\
 \hline
 6270 \\
 \cdot 1800 \\
 \hline
 1045 \\
 \cdot 7550 \\
 \hline
 7315 \\
 \cdot 235 \\
 \hline
 \hline
 \end{array}$$

(5) 2,574) 709,000 (275.4 *Ans.* (6) 8275) 5,714.00 (690.69 *Ans.*

$$\begin{array}{r}
 5148 \\
 \hline
 19420 \\
 \hline
 18018 \\
 \hline
 14020 \\
 \hline
 12870 \\
 \hline
 11500 \\
 \hline
 10296 \\
 \hline
 1204 \\
 \hline
 \hline
 \end{array}$$

$$\begin{array}{r}
 49650 \\
 \hline
 74900 \\
 \hline
 74475 \\
 \hline
 42 \\
 \hline
 \hline
 \end{array}$$

(7) 6,4252) 7382,5400 (1148.99 *Ans.*

$$\begin{array}{r}
 64252 \\
 \hline
 95734 \\
 \hline
 64252 \\
 \hline
 314820 \\
 \hline
 257008 \\
 \hline
 578120 \\
 \hline
 514016 \\
 \hline
 641040 \\
 \hline
 578268 \\
 \hline
 627720 \\
 \hline
 578268 \\
 \hline
 49452 \\
 \hline
 \hline
 \end{array}$$

Division of Decimals.

153

(8) $4323 \overline{) 0851648} (0000197 \text{ Ans.}$

$$\begin{array}{r} 4323 \\ 41934 \\ \underline{38907} \\ 30278 \\ 30261 \\ \underline{17} \\ \end{array}$$

(9) $1,25 \overline{) 267,15975} (213,727 \text{ Ans.}$

$$\begin{array}{r} 250 \\ \cdot 171 \\ 125 \\ \cdot 465 \\ 375 \\ \cdot 909 \\ 875 \\ \cdot 347 \\ 250 \\ \cdot 975 \\ 875 \\ 100 \\ \end{array}$$

(10) $1347 \overline{) 72,1564} (535,6 \text{ Ans.}$

$$\begin{array}{r} 6735 \\ \cdot 4806 \\ 4041 \\ \cdot 7654 \\ 6735 \\ \cdot 9190 \\ 8082 \\ 1108 \\ \end{array}$$

(11) 3705

Division of Decimals.

$$(^{11}) \quad .3075 \overline{) 715.0000} (2325 \text{ Ans.}$$

$$\begin{array}{r} 6150 \\ \hline 10000 \\ 9225 \\ \hline 7750 \\ 6150 \\ \hline 16000 \\ 15375 \\ \hline 6250 \\ 6150 \\ \hline 100 \\ \hline \hline \end{array}$$

CONTRACTED DIVISION OF DECIMALS.

$$(^{12}) \quad 2,257432 \overline{) 721.17562} (319,467 \text{ Ans.}$$

$$\begin{array}{r} 6772296 \\ \hline 439460 \\ 225743 \\ \hline 213717 \\ 203169 \\ \hline 10548 \\ 9030 \\ \hline 1518 \\ 1354 \\ \hline 164 \\ 158 \\ \hline 6 \\ \hline \hline \end{array}$$

$$(^{13}) \quad 5,2714167 \overline{) 8,758615} (1,66 \text{ Ans.}$$

$$\begin{array}{r} 5271 \\ \hline 3487 \\ 3163 \\ \hline 324 \\ 316 \\ \hline 8 \\ 5 \\ \hline 3 \\ \hline \hline \end{array}$$

$$(14) 8,7586)51717591(5904778,275 \text{ Ans.}$$

$$(15) 217,35)25,1367(.115 \text{ Ans.}$$

$$(16) ,123415)51,47542(417,092 \text{ Ans.}$$

$$(17) 7,9863)70,23(8,793 \text{ Ans.}$$

$$(18) 3,712)27,104(7,301 \text{ Ans.}$$

NOTE. This contracted method of Division, as well as that of Multiplication, will be found of excellent use to those who are employed in astronomical computations.

REDUCTION OF DECIMALS.

CASE I.

$$(1) \frac{1}{4} = 1,00 \div 4 = ,25 \text{ decimal, for } 4 : 1 :: 1,00 : ,25 \text{ Ans.}$$

$$(2) \frac{1}{2} = 1,0 \div 2 = ,5 \text{ decimal, for } 2 : 1 :: 1,0 : ,5, \text{ Ans.}$$

$$(3) \frac{3}{4} = 3,00 \div 4 = ,75 \text{ decimal, for } 4 : 3 :: 1,00 : ,75 \text{ Ans.}$$

$$(4) \frac{3}{8} = 3,000 \div 8 = ,375 \text{ decimal, for } 8 : 3 :: 1,000 : ,375 \text{ Ans.}$$

$$(5) \frac{5}{26} = 5,0000 \div 26 = ,1923 + \text{ decimal, for } 26 : 5 :: 1,0000 : ,1923 + \text{ Ans.}$$

$$(6) \text{ Here } \frac{1}{14} \text{ of } \frac{1}{3} = \frac{1 \times 1}{14 \times 3} = \frac{1}{42} = ,0238 + \text{ decimal req.}$$

$$(7) \begin{array}{r} s. \\ 20 \overline{) 5} \\ \text{Ans. } ,25 \\ \hline \end{array}$$

$$(8) \begin{array}{r} s. \\ 20 \overline{) 9} \\ \text{Ans. } ,45 \\ \hline \end{array}$$

$$(9) \begin{array}{r} s. \\ 20 \overline{) 16} \\ \text{Ans. } ,8 \\ \hline \end{array}$$

$$(10) \begin{array}{r} 12 \overline{) 4} \\ 20 \overline{) 8,33} \\ \text{Ans. } ,41\bar{6} \\ \hline \hline \end{array}$$

$$(11) \begin{array}{r} 4 \overline{) 3} \\ 12 \overline{) 7,75} \\ 20 \overline{) 16,64583} \\ \text{Ans. } ,832291\bar{6} \\ \hline \hline \end{array}$$

$$(12) \begin{array}{r} 2 \overline{) 1} \\ 12 \overline{) 5,5} \\ 20 \overline{) 19,4583} \\ \text{Ans. } ,9721\bar{6} \\ \hline \hline \end{array}$$

156 The Rule of Three in Decimals.

$$\begin{array}{l} (13) \quad 24 \overline{) 12} \\ \underline{20} 0,5 \\ 12 0,025 \\ \underline{00} 2082 \text{ Ans.} \end{array} \quad \begin{array}{l} (14) \quad 16 \overline{) 12} \\ \underline{16} 0,75 \\ 0,46875 \text{ Ans.} \end{array} \quad \begin{array}{l} (15) \quad 28 \overline{) 14} \\ \underline{4} 2,5 \\ 625 \text{ Ans.} \end{array}$$

$$\begin{array}{l} (16) \quad 8 \overline{) 2} \\ \underline{3} 0,25 \\ 082 \text{ Ans.} \end{array} \quad \begin{array}{l} (17) \quad 2 \overline{) 1} \\ \underline{4} 2,5 \\ 625 \text{ Ans.} \end{array} \quad \begin{array}{l} (18) \quad 4 \overline{) 2} \\ \underline{63} 4,5 \\ 071428 + \text{Ans.} \end{array}$$

$$\begin{array}{l} (19) \quad 4 \overline{) 1} \\ \underline{36} 2,25 \\ 0625 \text{ Ans.} \end{array} \quad \begin{array}{l} (20) \quad 52 \overline{) 365} = 142465 + \text{Ans.} \end{array}$$

CASE II.

$$\begin{array}{l} (21) \quad ,8322916 \times 20 \times 4 = \\ 36s. 7\frac{3}{4}d. \text{ Ans.} \end{array} \quad \begin{array}{l} (25) \quad ,625 \times 4 \times 2 = 2qts. 1p. \\ \text{Ans.} \end{array}$$

$$\begin{array}{l} (22) \quad ,002082 \times 12 \times 20 \times \\ 24 = 12 \text{ grs. Ans.} \end{array} \quad \begin{array}{l} (26) \quad ,071428 \times 63 \times 4 = \\ 4 \text{ gals. 2 qts. Ans.} \end{array}$$

$$\begin{array}{l} (23) \quad ,0446875 \times 16 \times 16 = \\ 12 \text{ dr. Ans.} \end{array} \quad \begin{array}{l} (27) \quad ,0625 \times 36 \times 4 = 2 \text{ gals.} \\ 1 \text{ qt. Ans.} \end{array}$$

$$\begin{array}{l} (24) \quad ,625 \times 4 \times 28 = 2 \text{ qrs.} \\ 14 \text{ lb. Ans.} \end{array} \quad \begin{array}{l} (28) \quad ,142465 \times 365 = 52 \\ da. \text{ Ans.} \end{array}$$

THE RULE OF THREE IN DECIMALS.

$$\begin{array}{l} (1) \text{ As } 26,5 \text{ yds.} : 3,8125 \text{ l.} :: 32,25 \text{ yds.} : \frac{3,8125 \times 32,25}{26,5} \\ = 4,63974 = 4 \text{ l. } 12s. 9\frac{1}{2}d. \text{ Ans.} \end{array}$$

$$\begin{array}{l} (2) \text{ As } 1 \text{ m.} : 1,275 \text{ l.} :: 540 \text{ m.} : 1,275 \times 540 = 688,5 = \\ 688 \text{ l. } 10s. \text{ Ans.} \end{array}$$

(3) As

Rule of Three in Decimals.

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(3) As 7,75 yds. : 2,6375 l. :: 140,5 yds. : $\frac{2,6375 \times 140,5}{7,75}$
 = 47,8153 = 47 l. 16 s. 3½ d. + Ans.

(4) As 7,625 cwt. : 36,6375 l. :: 2,4375 cwt. : $\frac{36,6375 \times 2,4375}{7,625}$
 = 11,71198 = 11 l. 14 s. 2¼ d. + Ans.

(5) First 24 ton. 12 cwt. 2 qrs. 14 lb. 12 oz. = 882796 oz.
 then we have, as 882796 oz. : 3678,316 l. :: 1 oz. : $\frac{3678,316}{882796}$
 = .00416 = 1 d. + Ans.

(6) As 1,5 lb. : 3,5 s. :: 326,5 lb. : $\frac{326,5 \times 3,5}{1,5}$
 = 761,25 s. = 38 l. 1 s. 3 d. Ans.

(7) As 480 gr. : 2,95 l. :: 9197 gr. : $\frac{9197 \times 2,95}{480}$
 = 56,5232 = 56 l. 10 s. 5½ d. + Ans.

(8) As 1 yd. : 10,5 l. :: 827,75 yds. : $\frac{827,75 \times 10,5}{1}$
 = 8691,375 d. = 36 l. 4 s. 3¼ d. + Ans.

(9) As 3625 yr. : 34 l. :: 416 yr. : $\frac{34 \times 416}{3625}$ = 3 l. 11 s. 10 d. Ans.

(10) As 75 yd. : 2,25 yd. :: 8 yd. : $\frac{2,25 \times 8}{75}$ = 2,4 yd. Ans.

(11) As 480 gr. : 5,5 s. :: 10804 gr. : $\frac{10804 \times 5,5}{480}$
 = 123,7958 s. = 6 l. 3 s. 9½ d. + Ans.

(12) As 1 lb. : 1,25 s. :: 1727 lb. : $\frac{1727 \times 1,25}{1}$ = 2158,75 s.
 = 107 l. 18 s. 9 d. Ans.

(13) As 112 lb. : 2,475 l. :: 5138 lb. : $\frac{5138 \times 2,475}{112}$
 = 113,540625 = 113 l. 10 s. 9¾ d. Ans.

O

(14) As

158 *Extraction of the Square Root.*

(¹⁴) As 1 cwt. : 2,8l. :: 40,5cwt.: $40,5 \times 2,8 = 113,4 =$
113l. 8s. *Anf.*

(¹⁵) As 5,3s. : 1oz. :: 212s. : $\frac{212}{5,3} = 39 \text{ oz. } 15 \text{ dwt.}$
Anf.

(¹⁶) As 2898 lb. : 187,1625l. :: 1 lb. : $\frac{187,1625}{2898} =$
664588 = 15d $\frac{1}{2}$. *Anf.*

(¹⁷) As 29,25 lb. : 10,5625l. :: 3 lb. : $\frac{10,5625 \times 3}{29,25} =$
1,088 = 1l. 1s. 8d. *Anf.*

(¹⁸) As 3,5 lb. : 1,088s. :: 112 lb. : $\frac{1,088 \times 112}{3,5} =$
34,8s. = 1l. 14s. 8d. *Anf.*

EXTRACTION OF THE SQUARE ROOT

(¹) 115025 (345 *Anf.*

$$\begin{array}{r} 9 \\ 64 \overline{) 290} \\ \underline{256} \\ 3425 \\ \underline{3425} \\ \end{array}$$

(²) 106929 (327 *Anf.*

$$\begin{array}{r} 9 \\ 62 \overline{) 169} \\ \underline{124} \\ 647 \overline{) 4529} \\ \underline{4529} \\ \end{array}$$

(³) 226

Extraction of the Square Root.

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(3) 2268741 (1506,23 Ans. (4) 7596796) 2756,228 Ans.

$$\begin{array}{r}
 \overset{1}{\overline{1}} \\
 25 \overline{) 126} \\
 \underline{125} \\
 3006 \overline{) 18741} \\
 \underline{18036} \\
 30122 \overline{) 70500} \\
 \underline{60244} \\
 301243 \overline{) 1025600} \\
 \underline{903729} \\
 \underline{121871}
 \end{array}$$

$$\begin{array}{r}
 \overset{4}{\overline{4}} \\
 47 \overline{) 359} \\
 \underline{329} \\
 545 \overline{) 3067} \\
 \underline{2725} \\
 5506 \overline{) 34296} \\
 \underline{33036} \\
 55122 \overline{) 126000} \\
 \underline{110244} \\
 551242 \overline{) 1575600} \\
 \underline{1102484} \\
 5512448 \overline{) 47311600} \\
 \underline{44099584} \\
 \underline{3212016}
 \end{array}$$

(5) 36372961 (6031 Ans.

$$\begin{array}{r}
 \overset{36}{\overline{36}} \\
 1203 \overline{) 3729} \\
 \underline{3609} \\
 12061 \overline{) 12061} \\
 \underline{12061} \\
 \dots
 \end{array}$$

(6) 22071204 (4698 Ans.

$$\begin{array}{r}
 \overset{16}{\overline{16}} \\
 86 \overline{) 607} \\
 \underline{516} \\
 929 \overline{) 9112} \\
 \underline{8361} \\
 9388 \overline{) 75104} \\
 \underline{75104} \\
 \dots
 \end{array}$$

(7) 3271,4207 (57,19 Ans. (8) 4795,257310 (69,247 Ans.

$$\begin{array}{r}
 \overset{25}{\overline{25}} \\
 107 \overline{) 771} \\
 \underline{749} \\
 1141 \overline{) 2242} \\
 \underline{1141} \\
 11429 \overline{) 110107} \\
 \underline{102861} \\
 \underline{7246}
 \end{array}$$

$$\begin{array}{r}
 \overset{36}{\overline{36}} \\
 129 \overline{) 1195} \\
 \underline{1161} \\
 1382 \overline{) 3425} \\
 \underline{2764} \\
 13844 \overline{) 66173} \\
 \underline{55376} \\
 138487 \overline{) 1079710} \\
 \underline{969409} \\
 \underline{110301}
 \end{array}$$

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(⁹) $\sqrt{4,372594}$ (2,091 Ans.

$$\begin{array}{r} 4 \\ 409 \overline{) 3725} \\ \underline{3681} \\ 4181 \overline{) 4494} \\ \underline{4181} \\ \underline{313} \end{array}$$

(¹⁰) $\sqrt{2,27109570}$ (1,50701 Ans.

$$\begin{array}{r} 1 \\ 25 \overline{) 127} \\ \underline{125} \\ 307 \overline{) 21095} \\ \underline{21049} \\ 301401 \overline{) 467000} \\ \underline{301401} \\ \underline{105599} \end{array}$$

(¹¹) $\sqrt{,00032754}$ (,01809 Ans.

$$\begin{array}{r} 1 \\ 28 \overline{) 227} \\ \underline{224} \\ 3609 \overline{) 35400} \\ \underline{32481} \\ \underline{2919} \end{array}$$

(¹²) $\sqrt{1,270054}$ (1,1269 Ans.

$$\begin{array}{r} 1 \\ 21 \overline{) 27} \\ \underline{21} \\ 222 \overline{) 600} \\ \underline{444} \\ 2246 \overline{) 15654} \\ \underline{13476} \\ 22529 \overline{) 217800} \\ \underline{222761} \\ \underline{15039} \end{array}$$

To extract the Square Root of a Vulgar Fraction.

(¹³) The given fraction in its lowest terms is $\frac{4}{9}$, whose square root is $\sqrt{\frac{4}{9}} = \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3}$, the answer required.

(¹⁴) The given fraction in its lowest terms is $\frac{16}{25}$, whose square root is $\sqrt{\frac{16}{25}} = \frac{\sqrt{16}}{\sqrt{25}} = \frac{4}{5}$, the answer required.

(¹⁵) The given fraction in its lowest terms is $\frac{36}{49}$, whose square root is $\sqrt{\frac{36}{49}} = \frac{6}{7}$, the answer required.

SURDS.

Extraction of the Square Root.

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SURDS.

(¹⁶) The given fraction is $=\frac{25}{31}$, in decimals $=,8064516129$, whose root is $\sqrt{,8064516129}=,89302+$ the answer req.

(¹⁷) The given fraction is $\frac{3}{4}$, in decimals $=,75$, whose root is $\sqrt{,75}=,86602+$ the answer required.

(¹⁸) The given fraction reduced to a decimal is $,8706739524$, whose root is $\sqrt{,8706739524}=,93309+$ the answer required.

OF MIXED NUMBERS.

(¹⁹) Here $51\frac{21}{8}=1\frac{296}{3}$, whose root is $\sqrt{1\frac{296}{3}}=\frac{\sqrt{1296}}{\sqrt{25}}=7\frac{1}{5}$, Ans.

(²⁰) Here $27\frac{9}{6}=4\frac{41}{8}$, whose root is $\sqrt{4\frac{41}{8}}=2\frac{1}{4}=5\frac{1}{4}$, Ans.

(²¹) Here $9\frac{43}{9}=4\frac{84}{9}$, whose root is $\sqrt{4\frac{84}{9}}=2\frac{2}{3}=3\frac{1}{3}$, Ans.

SURDS.

(²²) Here $85\frac{14}{3}=85,93$, whose root is $\sqrt{85,93}=9,27+$ Ans.

(²³) Here $8\frac{5}{7}=8,714285$, whose root is $\sqrt{8,714285}=2,9519+$ Ans.

(²⁴) Here $6\frac{2}{3}=6,4$, whose root is $\sqrt{6,4}=2,5298+$ Ans.

THE APPLICATION.

(¹) $576 \times 576 = 331776$, the number of men in the whole army.

(²) $97 \times 97 = 9409$, the number of square feet required.

How to find a mean proportional between any two numbers.

(³) Here $\sqrt{3 \times 12} = 6$, the mean proportional required.

(⁴) Here $4276 \times 842 = 3600392$, then $\sqrt{3600392} = 1897,4+$ the mean proportional required.

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How to find the side of a square equal in area to any given superficies.

(⁵) Here $\sqrt{160} = 12,649 +$ the side of the square required.

(⁶) Here $\sqrt{750} = 27,38612 +$ the side of the square req.

The area of a circle given to find the diameter.

(⁷) First as $1 : 1,273239 :: 160 : 1,273239 \times 160 = 203,718240$, then $\sqrt{203,718240} = 14,272$ the diameter in perches; again, $14,272 \div 2 = 7,136 +$ the radius, from which deduct one perch for the length of the cow and tail, and we have $6,136 +$ perches, the answer required.

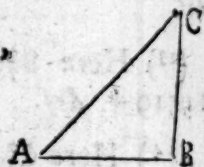
The area of any circle being given to find its periphery or circumference.

(⁸) As $1 : 12,56637 :: 12 : 12,56637 \times 12 = 150,79644$, then $\sqrt{150,79644} = 12,2798$, the periphery.

(⁹) As $1 : 12,56637 :: 160 : 12,56637 \times 160 = 2010,6192$, then $\sqrt{2010,6192} = 44,839 +$ circumference.

The base and perpendicular being given to find the hypotenuse.

(¹⁰) Here $AB^2 + BC^2 = 45^2 + 60^2 = 5625$, then $\sqrt{5625} = 75 = AC$, the hypotenuse, or length of the ladder required.



(¹¹) Here $AB^2 + BC^2 = 25^2 + 30^2 = 1525$, then $\sqrt{1525} = 39,05 + = AC$ the length of the ladder.

Any number of men being given to form them into a square battalia, or to find the number of rank and file.

(¹²) Here $\sqrt{331776} = 576$, the number of rank and file.

(¹³) Here $\sqrt{48841} = 221$, the number contained in one of the sides.

NOTE.

NOTE. Examples in the Square Root, may be very often expeditiously solved by using the following rule, for which reason we have taken the liberty of inserting it.

RULE. Find the nearest square to the given number whose root is required; then thrice the nearest square, added to the given number, is to thrice the given number added to the nearest square, as the root of the nearest square, to the root required nearly.

EXTRACTION OF THE CUBE ROOT.

(1)

99252847 (463 root.

Divisor 64 = cube of 4.

Square of $4 \times 3 = 48$) 35252 resolvend.

216 = cube of 6.

432 = $4 \times 3 \times$ ed by the square of 6.

288 = divisor \times ed by 6.

Divisor 33336 subtrahend.

Square of 46×3

= 6348) 1916847 resolvend.

27 = cube of 3.

1242 = $46 \times 3 \times$ ed by square of 3.

19044 = divisor \times ed by 3.

1916847 subtrahend.

(2) Square of $7 \times 3 = 147$ divisor.

Square of 3 put to 147 = 14709

$3 \times 3 \times 7 = 63$

15339 $\times 3 = 46017$

389017 (73 root.

343

46017

46017

.....

(3) Square

(3) Square of $1 \times 3 = 3$ divisor.Square of 7 put to $3 = 349$

$$7 \times 3 \times 1 = 21$$

Square of $17 \times 3 = 867$ divisor.Square of 9 put to $867 = 86781$

$$9 \times 3 \times 17 = 459$$

$$91371 \times 9 =$$

5735339 (179 root.

1

4735

3913

822339

822339

.....

(4) Square of $3 \times 3 = 27$ divisor.Square of 1 put to $27 = 2701$

$$1 \times 3 \times 3 = 9$$

$$2791 \times 1 =$$

Square of $31 \times 3 = 2883$ divisor.Square of 9 put to $2883 = 288381$

$$9 \times 3 \times 31 = 837$$

$$296751 \times 9 = 2670759$$

.....

(5) Square of $4 \times 3 = 48$ divisor.Square of 3 put to $48 = 4809$

$$3 \times 3 \times 4 = 36$$

$$5169 \times 3 =$$

Square of $43 \times 3 = 5547$ divisor.Square of 9 put to $5547 = 554781$

$$9 \times 3 \times 43 = 1161$$

$$566391 \times 9 = 5097519$$

.....

(6) Square

(6) Square of $6 \times 3 = 108$ divisor. 259694072 (638 root.)
 Square of 3 put to $108 = 10809$ $\underline{216}$
 $3 \times 3 \times 6 = 54$ $\underline{43694}$
 $11349 \times 3 = 34047$ $\underline{9647072}$
 Square of $63 \times 3 = 11908$ divisor.
 Square of 8 put to $11908 = 1190764$
 $8 \times 3 \times 63 = 1512$
 $1205884 \times 8 = 9647072$

(7) Square of $3 \times 3 = 27$ divisor. 48228544 (364 root.)
 Square of 6 put to $27 = 2736$ $\underline{27}$
 $6 \times 3 \times 3 = 54$ $\underline{21228}$
 $3276 \times 6 = 19656$ $\underline{1572544}$
 Square of $36 \times 3 = 3888$ divisor.
 Square of 4 put to $3888 = 388816$
 $4 \times 3 \times 36 = 432$
 $393136 \times 4 = 1572544$

NOTE. The reader will here please to observe that we have solved the first of these questions by our author's first rule, and the other six by his second, we shall therefore add the two following useful rules, by one or other of which we shall solve the remainder by.

RULE I.

Find the nearest root of the first period, whether greater or less than the truth, and thereto annex cyphers to supply the vacancy of the remaining figures to be had in the root; divide the difference between four times the number to be extracted, and this root (so ordered) by thrice the said root, then the square root of the quotient add to the assumed root, will be equal to twice the required root; or such root may be taken for a new operation, if more accuracy be wanted.

RULE

RULE II.

Find the nearest cube to the given number whose root is required; then twice the nearest cube, added to the given number, will be to twice the given number added to the nearest cube, as the root of the nearest cube, to the root required; then if this last quotient be assumed as the root of the nearest cube, and the operation repeated, the root may be found to any exactness required.

(8) Operation by } 27054036008 (3000 = nearest root.
the first rule. } 4
108216144032 = 4 times the given numb.
27000000000 = cube of the nearest root.
Thrice the } 9|000) 81216144|032 = difference.
nearest root. } 9024016 (3004 = square root.
9 3000 = assumed root.
6004) 024016
24016 2)6004 = sum.
...
3002 = cube root req.

(9) Operation by } 22069810125 (2800 = nearest root.
the first rule. } 4
88279240500 = 4 times the given numb.
21952000000 = cube of the nearest root.
Thrice the } 84|00) 663272405|00 = difference.
nearest root } 7896100 (2810 = square root.
2800 = assumed root.
2)5610 = sum.
2805 = cube root required.

(10) Operation

Extraction of the Cube Root: 167

(¹⁰) Operation by } the first rule, } 122615327232 (5000 = nearest root.

$$\begin{array}{r} 4 \\ 490461308928 = 4 \text{ times given numb.} \\ 125000000000 = \text{cube of nearest root.} \end{array}$$

Thrice the } 15|000 } 365461308|928 = difference.

nearest root, } 24364087 (4936 = square root.

5000 = assumed root.

$$2) 9936 = \text{sum.}$$

$$4968 = \text{root required.}$$

(¹¹) Operation by } the first rule. } 219365327791 (6000 = nearest root.

$$\begin{array}{r} 4 \\ 877461311164 = 4 \text{ times the given numb.} \\ 216000000000 = \text{cube of the nearest root.} \end{array}$$

Thrice the } 18|000 } 661461311|164 = difference.

nearest root } 36747850 (6062 = square root.

6000 = assumed root.

$$2) 12062 = \text{sum.}$$

$$6031 = \text{cube root required.}$$

(¹²) Operation by } the first rule. } 673373097125 (8700 = nearest root.

$$\begin{array}{r} 4 \\ 2693492388500 = 4 \text{ times given numb.} \\ 658503000000 = \text{cube of the nearest root} \end{array}$$

Thrice the } 261|00 } 20349893885|00 = difference.

nearest root } 77908942 (8830 = square root.

8700 = assumed root.

$$2) 17530 = \text{sum.}$$

$$8765 = \text{cube root required.}$$

(¹³) Operation by the second rule:— Assume 2,3 as the root of the nearest cube, then $2,3^3 \times 2 + 12,977875 : 12,977875, \times 2 + 2,3 :: 2,3^3$ or $37,311875 : 38,12275 :: 2,3 : 2,35$, the root required.

(¹⁴) Operation

SURDS.

(²¹) Here $\frac{4}{7} = .571428$, whose root is $\sqrt[3]{.571428} = .829 +$
Ans.

(²²) Here $\frac{5}{8} = .625$, whose root is $\sqrt[3]{.625} = .822 +$ *Ans.*

(²³) Here $\frac{2}{3} = .666$, whose root is $\sqrt[3]{.666} = .873 +$ *Ans.*

OF MIXED NUMBERS.

(²⁴) Here $12\frac{1}{2} = 12.5$, whose root is $\sqrt[3]{12.5} = 2.3 +$ *Ans.*

(²⁵) Here $31\frac{1}{2} = 31.5$, whose root is $\sqrt[3]{31.5} = 3.2 +$ *Ans.*

(²⁶) Here $405\frac{1}{2} = 405.5$, whose root is $\sqrt[3]{405.5} = 7.4 +$ *Ans.*

SURDS.

(²⁷) Here $7\frac{1}{2} = 7.5$, whose root is $\sqrt[3]{7.5} = 1.93 +$ *Ans.*

(²⁸) Here $9\frac{1}{8} = 9.125$, whose root is $\sqrt[3]{9.125} = 2.092 +$ *Ans.*

(²⁹) Here $8\frac{1}{2} = 8.5$, whose root is $\sqrt[3]{8.5} = 2.057 +$ *Ans.*

THE APPLICATION.

(¹) Here $47 \times 47 \times 47 = 47^3 = 103823$ cubical inches the *Ans.*

(²) Here $12 \times 12 \times 12 = 12^3 = 1728$ solid feet the *Answer.*

(3) 389017 (70 = the nearest root,

4

1556068 = 4 times the given number,

343000 = cube of the nearest root.

Thrice the } 210) 121306 | 8 = difference.
nearest root. }

5776 (76 = square root.

70 = assumed root.

2) 146 sum73 = the cube root.Then $73 \times 73 = 5329$ the superficial content required.*Between two numbers given, to find two mean proportionals.*(4) First 6) 162 (27, whose root is $\sqrt[3]{27} = 3$, then $6 \times 3 = 18$ the least mean, and $18 \times 3 = 54$ the greater.(5) First 4) 108 (27, whose root is $\sqrt[3]{27} = 3$, then $4 \times 3 = 12$ the least mean, and $12 \times 3 = 36$ the greater.*How to find the side of a cube that shall be equal in solidity to any given solid, as globe, cylinder, cone, prism, &c.*

(6) 10648 (20 = nearest root.

4

42592 = 4 times the given number,

8000 = cube of the nearest root.

Thrice the } 60) 3459 | 2 = difference
nearest root. }

576 (24 = square root.

20 = assumed root.

2) 44 sum,22 the answer required.*Having the side of a cube, to find the side of another that shall be double, treble, &c. in solidity to that given.*(7) First $12^3 = 1728$, then $1728 \times 3 = 5184$, whose root is $\sqrt[3]{5184} = 17.307$ inches, the side of another vessel that will hold three times as much.

THE BIQUADRATE ROOT.

(1) First $27 \times 27 = 729$, then $729^2 = 531441$ the biq. req.

(2) First $76^2 = 5776$, then $5776^2 = 33362176$ the biq. req.

(3) First $275^2 = 75625$, then $75625^2 = 5719140625$ biq. req.

(4) Here $531441 \sqrt{729} = \text{sq. root}$, and $729 \sqrt{27} = \text{the b. r. req.}$

$$\begin{array}{r} 49 \\ \hline 142 \overline{) 414} \\ \underline{284} \\ 1449 \overline{) 13041} \\ \underline{13041} \\ \dots \end{array} \qquad \begin{array}{r} 4 \\ \hline 47 \overline{) 329} \\ \underline{329} \\ \dots \end{array}$$

(5) First the square root of 33362176 is $= 5776$, then $\sqrt{5776} = 76$ the biquadrate root required.

(6) First the square root of 5719140625 is $= 75625$, then $\sqrt{75625} = 275$ the biquadrate root required.

How to Extract the Roots of all Powers.

(1) $141376 \sqrt{376} = \text{square root.}$

$$\begin{array}{l} 9 \\ \hline 6 \overline{) 51} \text{ dividend. } 3 \times 2 = 6 \text{ divisor.} \\ \hline 1369 \text{ subtrahend. } 37 \times 37 = 1369 \text{ subtrahend.} \\ \hline 74 \overline{) 447} \text{ dividend. } 37 \times 2 = 74 \text{ divisor.} \\ \hline 141376 \text{ subtrahend. } 376 \times 376 = 141376 \text{ subtrahend.} \end{array}$$

(²) $\sqrt[3]{53157376}$ (376 = the cube root required.)

27

27)261 dividend.

50653 subtrahend.

4107)25043 dividend.

53157376 subtrahend.

$3 \times 3 \times 3 = 27$ divisor.

$37 \times 37 \times 37 = 50653$ subtrahend.

$37 \times 37 \times 3 = 4107$ divisor.

$376 \times 376 \times 376 = 53157376$ subtrahend.

(³) $\sqrt[4]{19987173376}$ (376 = the biquadrate root required.)

81

108)1188 dividend.

1874161 subtrahend.

202612)1245563 dividend.

19987173376 subtrahend.

$3 \times 3 \times 3 \times 4 = 108$ divisor.

$37 \times 37 \times 37 \times 37 = 1874161$ subtrahend.

$37 \times 37 \times 37 \times 4 = 202612$ divisor.

$376 \times 376 \times 376 \times 376 = 19987173376$ subtrahend.

SIMPLE INTEREST.

THEOREM I. $ptr = I$.

(¹) Here, $p = 945,5l.$ $t = 3$ and $r = .05$, whence $945,5l. \times .05 \times 3 = 141,825 = 141l. 16s. 6d.$ Ans.

(²) $547,7l. \times .04 \times 6 = 131,448 = 131l. 8s. 11\frac{1}{2}d. - 08$ Ans.

(³) $796,75l. \times .04 \times 5 = 179,26875 = 179l. 5s. 4\frac{1}{2}d.$ Ans.

(⁴) $397,47083l. \times .05 \times 2,5 = 34,7786979 = 34l. 15s. 6\frac{3}{4}d. - 55$ Ans.

$$(1) 554.875 \text{ l.} \times .045 \times 3.6 = 91.554375 = 91 \text{ l. } 11 \text{ s. } 1 \text{ d.} - 2 \text{ Ans.}$$

$$(6) 236.93 \text{ l.} \times .055 \times 3.6 = 47.781555416 = 47 \text{ l. } 15 \text{ s. } 7 \frac{1}{2} \text{ d.} - 2932 \text{ Ans.}$$

How to find the Interest for any number of days.

$$(7) .00010958904 \times 240 \times 120 = 3.156164352 = 3 \text{ l. } 3 \text{ s. } 1 \frac{1}{2} \text{ d.} 9 + \text{Ans.}$$

$$(8) .00016438356 \times 563 \times 126 = 11.66104 + = 11 \text{ l. } 13 \text{ s. } 2 \frac{1}{2} \text{ d.} 59934 + \text{Ans.}$$

$$(9) .0001369863 \times 560 \times 60 = 4.60273968 = 4 \text{ l. } 12 \text{ s. } 0 \frac{1}{2} \text{ d.} 63 + \text{Ans.}$$

$$(10) .0001369863 \times 364.9 \times 154 = 7.69789 + = 7 \text{ l. } 13 \text{ s. } 11 \frac{1}{4} \text{ d.} 97 + \text{Ans.}$$

$$(11) .00010958904 \times 725.75 \times 74 = 5.885534 = 5 \text{ l. } 17 \text{ s. } 8 \frac{1}{2} \text{ d.} 1128 + \text{Ans.}$$

(12) The number of days from the 1st of June, 1796, to the 9th of March following, is easily found by our author's table, to be 281 days, whence $.0001369863 \times 100 \times 281 = 3.84931503 = 3 \text{ l. } 16 \text{ s. } 11 \frac{3}{4} \text{ d.} 3424 + \text{Ans.}$

THEOREM 2. $ptr + p = A$.

(13) Here $p = 279.6 \text{ l.}$ $i = 7$, and $r = .045$, whence $279.6 \times .045 \times 7 + 279.6 = 367.674 = 367 \text{ l. } 13 \text{ s. } 5 \frac{3}{4} \text{ d.} - 04 \text{ Ans.}$

(14) $320.85 \times .035 \times 5 + 320.85 = 376.99875 = 376 \text{ l. } 19 \text{ s. } 11 \frac{1}{2} \text{ d.} - 8 \text{ Ans.}$

(15) $679.65 \times .05 \times 6 + 679.65 = 883.545 = 883 \text{ l. } 10 \text{ s. } 10 \frac{3}{4} \text{ d.} - 2 \text{ Ans.}$

(16) $926.6 \times .04 \times 5.5 + 926.6 = 1130.452 = 1130 \text{ l. } 9 \text{ s. } 0 \frac{1}{4} \text{ d.} - 92 \text{ Ans.}$

$$(17) \quad 368,8 \times ,065 \times 7,75 + 368,8 = 554,583 = 554\text{ l. } 11\text{ s. } 7\frac{1}{2}\text{ d. } - 68 \text{ Ans.}$$

$$(18) \quad 273,9 \times ,03 \times 4,479452 + 273,9 = 310,707657084 = 310\text{ l. } 14\text{ s. } 1\frac{3}{4}\text{ d. } - 35 + \text{Ans.}$$

$$\text{THEOREM 3. } \frac{a}{tr+1} = P.$$

$$(19) \quad \text{Here } a = 367,674, t = 7, \text{ and } r = ,045, \text{ whence}$$

$$\frac{367,674}{7 \times ,045 + 1} = 279,6 = 279\text{ l. } 12\text{ s. } \text{Ans.}$$

$$(20) \quad \text{Here } \frac{376,99875}{5 \times ,035 + 1} = 320,85 = 320\text{ l. } 17\text{ s. } \text{Ans.}$$

$$(21) \quad \text{Here } \frac{883,545}{6 \times ,05 + 1} = 679,65 = 679\text{ l. } 13\text{ s. } \text{Ans.}$$

$$(22) \quad \text{Here } \frac{1130,452}{5,5 \times ,04 + 1} = 926,6 = 926\text{ l. } 12\text{ s. } \text{Ans.}$$

$$(23) \quad \text{Here } \frac{554,583}{7,75 \times ,065 + 1} = 368,8 = 368\text{ l. } 16\text{ s. } \text{Ans.}$$

$$(24) \quad \text{Here } \frac{310,707657084}{4,479452 \times ,03 + 1} = 273,9 = 273\text{ l. } 18\text{ s. } \text{Ans.}$$

$$\text{THEOREM 4. } \frac{a-p}{pt} = R.$$

$$(25) \quad \text{Here } a = 367,674\text{ l. } p = 279,6\text{ l. } \text{ and } t = 7, \text{ whence}$$

$$\frac{367,674 - 279,6}{279,6 \times 7} = ,045, \text{ or } 4\frac{1}{2}\text{ l. the rate per cent.}$$

$$(26) \quad \text{Here } \frac{376,99875 - 320,85}{320,85 \times 5} = ,035, \text{ or } 3\frac{1}{2}\text{ l. the rate per$$

cent.

(27) Here

(²⁷) Here $\frac{883,545 - 679,65}{679,65 \times 6} = ,05$, or 5% the rate per cent.

(²⁸) Here $\frac{1130,452 - 926,6}{926,6 \times 5,5} = ,04$, or 4% the rate per cent.

(²⁹) Here $\frac{554,583 - 368,8}{368,8 \times 7,75} = ,065$, or 6½% the rate per cent.

(³⁰) Here $\frac{310,707657084 - 273,9}{273,9 \times 4,479452} = ,03$, or 3% the rate per cent.

THEOREM 5. $\left. \begin{array}{l} a - p \\ pr \end{array} \right\} = T.$

(³¹) Here $a = 367,674$. $p = 279,6$. and $r = ,045$, whence $\frac{367,674 - 279,6}{279,6 \times ,045} = 7$ years, the time required.

(³²) Here $\frac{376,99875 - 320,85}{320,85 \times ,035} = 5$ years, the time req.

(³³) Here $\frac{883,545 - 679,65}{679,65 \times ,05} = 6$ years, the time required.

(³⁴) Here $\frac{1130,432 - 926,6}{926,6 \times ,04} = 5\frac{1}{2}$ years, the time required.

(³⁵) Here $\frac{554,583 - 368,8}{368,8 \times ,065} = 7\frac{3}{4}$ years, the time required.

(³⁶) Here $\frac{310,707657084 - 273,9}{273,9 \times ,03} = 4,479452 + = 4$ yrs and 175 days, the time required.

ANNUITIES OR PENSIONS, &c. IN ARREARS.

$$\text{THEOREM 1. } \frac{tu - tu}{2} \times r + tu = A.$$

(37) Here $u = 150\text{!}$, $t = 5$, and $r = .05$, whence
 $\frac{5 \times 5 \times 150 - 5 \times 150}{2} \times .05 + 5 \times 150 = 825\text{!}$ the amount
 required.

(38) Here $\frac{7 \times 7 \times 250 - 7 \times 250}{2} \times .06 + 7 \times 250 =$
 2065! the amount required.

(39) Here $\frac{5.5 \times 5.5 \times 60 - 5.5 \times 60}{2} \times .045 + 5.5 \times 60 =$
 $363.4125 = 363\text{!}$ 8s. 3d. the amount required.

(40) Here $\frac{8 \times 8 \times 28 - 8 \times 28}{2} \times .05 + 8 \times 28 = 263.2 =$
 263! 4s. the amount required.

When the annuities, &c. are to be paid half-yearly or quarterly.

(41) Here $\frac{10 \times 10 \times 75 - 10 \times 75}{2} \times .025 + 10 \times 75 =$
 $834.375 = 834\text{!}$ 7s. 6d. the amount at half-yearly pay-
 ments.

(42) Here $\frac{20 \times 20 \times 37.5 - 20 \times 37.5}{2} \times .0125 + 20 \times 37.5 =$
 $839.0625 = 839\text{!}$ 1s. 3d. the amount at quarterly pay-
 ments.

$$\text{THEOREM 2. } \frac{2a}{tr - tr + 2t} = U.$$

(43) Here $a = 825\text{!}$, $t = 5$ and $r = .05$, whence
 $\frac{825 \times 2}{5 \times 5 \times .05 - 5 \times .05 + 2 \times 5} = 150\text{!}$ the salary required.

(44) Here

(44) Here $\frac{363,4125 \times 2}{5,5 \times 5,5 \times ,045 - 5,5 \times ,045 + 2 \times 5,5} = 60\%$.
the yearly rent required.

(45) Here $\frac{2065 \times 2}{7 \times 7 \times ,06 - 7 \times ,06 \times 2 \times 7} = 250\%$. the pension
required.

(46) Here $\frac{263,2 \times 2}{8 \times 8 \times ,05 - 8 \times ,05 + 2 \times 8} = 28\%$. the pension
required.

Of half-yearly payments, &c.

(47) Here $\frac{834,375 \times 4}{10 \times 10 \times ,025 - 10 \times ,025 + 2 \times 10} = 150\%$. the
half-yearly salary required.

(48) Here $\frac{839,0625 \times 8}{20 \times 20 \times ,0125 - 20 \times ,0125 + 2 \times 20} = 150\%$.
the quarterly salary required.

THEOREM 3. $\frac{2a - 2tu}{tu - tu} = R.$

(49) Here $a = 825\%$. $u = 150\%$. and $t = 5$, whence
 $\frac{825 \times 2 - 2 \times 5 \times 150}{5 \times 5 \times 150 - 5 \times 150} = ,05$ or 5% . the rate per cent.

(50) Here $\frac{363,4125 \times 2 - 60 \times 2 \times 5,5}{5,5 \times 5,5 \times 60 - 5,5 \times 60} = ,045$, or $4\frac{1}{2}\%$.
the rate per cent.

(51) Here $\frac{2065 \times 2 - 2 \times 250 \times 7}{7 \times 7 \times 250 - 250 \times 7} = ,06$, or 6% . the rate
per cent.

(52) Here $\frac{263,2 \times 2 - 2 \times 28 \times 8}{8 \times 8 \times 28 - 8 \times 28} = ,05$, or 5% . the rate
per cent.

When

When the payments are half-yearly, &c.

(53) Here $\frac{814,375 \times 4 - 150 \times 4 \times 5}{75 \times 10 \times 10 - 75 \times 10} = .05$, or 5% the rate per cent.

(54) Here $\frac{839,0625 \times 8 - 150 \times 8 \times 5}{37.5 \times 20 \times 20 - 37.5 \times 20} = .05$, or 5% the rate per cent.

THEOREM 4. $\sqrt{\frac{2a}{ru} + \frac{xx}{4}} - \frac{x}{2} = T$; when $x = \frac{2}{r} - 1$.

(55) Here $a = 825$, $u = 150$, and $r = .05$, then $\frac{2}{.05} - 1 = 39$, and $\sqrt{\frac{825 \times 2}{150 \times .05} + \frac{39 \times 39}{4}} - \frac{39}{2} = 5$ years, the time required.

(56) First $\frac{2}{.045} - 1 = 43.4$, then $\sqrt{\frac{263,4125 \times 2}{60 \times .045} + \frac{43.4 \times 43.4}{4}} - \frac{43.4}{2} = 5\frac{1}{2}$ years, the time required.

(57) First $\frac{2}{.06} - 1 = 32.8$, then $\sqrt{\frac{2065 \times 2}{250 \times .06} + \frac{32.8 \times 32.8}{4}} - \frac{32.8}{2} = 7$ years, the time required.

(58) First $\frac{2}{.05} - 1 = 39$, then $\sqrt{\frac{263,2 \times 2}{28 \times .05} + \frac{39 \times 39}{4}} - \frac{39}{2} = 8$ years, the time required.

When

Simple Interest.

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When the payments are half-yearly, &c.

(59) First $\frac{2}{,025} - 1 = 79$, then $\sqrt{\frac{834,375 \times 2}{75 \times ,025} + \frac{79 \times 79}{4}}$
 $-\frac{79}{2} = 10$, the number of payments; hence 5 years was the time the payment was forborne.

(60) First $\frac{2}{,0125} - 1 = 159$, then $\sqrt{\frac{839,0625 \times 2}{37,5 \times ,0125} + \frac{159 \times 159}{4}}$
 $-\frac{159}{2} = 20$, the number of payments; hence 5 years was the time of forbearance.

PRESENT WORTH OF ANNUITIES.

THEOREM 1. $\frac{1 - (1 + r)^{-t}}{r} \times u = P.$

(61) Here $u = 150$, $t = 5$, and $r = ,05$, whence
 $\frac{5 \times 5 \times ,05 - 5 \times ,05 + 2 \times 5}{2 \times 5 \times ,05 + 2} \times 150 = 660$, the present worth required.

(62) Here $\frac{5 \times 5 \times 5 \times ,045 - 5 \times 5 \times ,045 + 2 \times 5 \times 5}{2 \times 5 \times ,045 + 2} \times 60 =$
 $291,3175 = 219$ l. 6s. 3d. the present worth required.

(63) Here $\frac{7 \times 7 \times ,06 - 7 \times ,06 + 2 \times 7}{2 \times 7 \times ,06 + 2} \times 150 = 1454,225$
 $= 1454$ l. 4s. 6d. the present worth required.

(64) Here $\frac{8 \times 8 \times ,05 - 8 \times ,05 + 2 \times 8}{2 \times 8 \times ,05 + 2} \times 28 = 1887$. the present worth required.

How

How to find the present worth of any sum of money payable half-yearly, &c.

(⁶⁵) Here $\frac{10 \times 10 \times ,025 - 10 \times ,025 + 2 \times 10}{2 \times 10 \times ,025 + 2} \times 75 = 667,5 = 697l. 10s.$ the present worth required.

(⁶⁶) Here $\frac{20 \times 20 \times ,0125 - 20 \times ,0125 + 2 \times 20}{2 \times 20 \times ,0125 + 2} \times 37,5 = 671,25 = 671l. 5s.$ the present worth required.

THEOREM 2. $\frac{tr+1}{11r-tr+2t} \times 2p = U.$

(⁶⁷) Here $p = 660l. t = 5,$ and $r = ,05,$ whence $\frac{5 \times ,05 + 1}{5 \times 5 \times ,05 - 5 \times ,05 + 2 \times 5} \times 660 \times 2 = 150l.$ the salary req.

(⁶⁸) Here $\frac{5,5 \times ,045 + 1}{5,5 \times 5,5 \times ,045 - 5,5 \times ,045 + 2 \times 5,5} \times 291,3175 \times 2 = 60l.$ the yearly rent required.

(⁶⁹) Here $\frac{7 \times ,c6 + 1}{7 \times 7 \times ,06 - 7 \times ,06 + 2 \times 7} \times 1454,225 \times 2 = 250l.$ the annuity required.

(⁷⁰) Here $\frac{8 \times ,05 + 1}{8 \times 8 \times ,05 - 8 \times ,05 + 2 \times 8} \times 188 \times 2 = 28l.$ the annuity required.

When the payments are half-yearly, &c.

(⁷¹) Here $\frac{10 \times ,025 + 1}{10 \times 10 \times ,025 - 10 \times ,025 + 2 \times 10} \times 667,5 \times 4 = 150l.$ Ans.

(⁷²) Here $\frac{20 \times ,0125 + 1}{20 \times 20 \times ,0125 - 20 \times ,0125 + 2 \times 20} \times 671,25 \times 8 = 150l.$ Ans.

THEOREM 3. $\frac{tu - p \times 2}{2pt + tu - ttu} = R.$

(73) Here $p = 660$, $u = 150$, and $t = 5$, whence

$$\frac{150 \times 5 - 660 \times 2}{2 \times 660 \times 5 + 5 \times 150 - 5 \times 5 \times 150} = ,05, \text{ or } 5\% \text{ the rate per cent.}$$

(74) Here $\frac{60 \times 5,5 - 291,2175 \times 2}{2 \times 291,3175 \times 5,5 + 5,5 \times 60 - 5,5 \times 5,5 \times 60} = ,045, \text{ or } 4\frac{1}{2}\% \text{ the rate per cent.}$

(75) Here $\frac{7 \times 250 - 1454,225 \times 2}{2 \times 1454,225 \times 7 + 7 \times 250 - 7 \times 7 \times 250} = ,06 \text{ or } 6\% \text{ the rate per cent.}$

(76) Here $\frac{8 \times 28 - 188 \times 2}{2 \times 188 \times 8 + 28 \times 8 - 8 \times 8 \times 28} = ,05, \text{ or } 5\% \text{ the rate per cent.}$

When the annuities are to be paid half-yearly, &c.

(77) Here $\frac{10 \times 75 - 667,5 \times 2}{2 \times 667,5 \times 10 + 10 \times 75 - 10 \times 10 \times 75} = ,025, \text{ or } 2\frac{1}{2}\% \text{ the rate per cent.}$

(78) Here $\frac{20 \times 37,5 - 671,25 \times 2}{2 \times 671,25 \times 20 + 20 \times 37,5 - 20 \times 20 \times 37,5} = ,0125, \text{ or } 1\frac{1}{8}\% \text{ the rate per cent.}$

THEOREM

THEOREM 4. $\sqrt{\frac{2p}{rn} + \frac{xx}{4} - \frac{x}{2}} = T$; when $x = \frac{2}{r} - \frac{2p}{u} - 1$.

(79) Here $p = 660\%$, $u = 150\%$, and $r = .05$, then $\frac{2}{.05} - \frac{660 \times 2}{150} - 1 = 30.2$ and $\sqrt{\frac{660 \times 2}{150 \times .05} + \frac{30.2 \times 30.2}{4} - \frac{30.2}{2}} = 5$ years, the time of continuance.

(80) First $\frac{2}{.045} - \frac{291,3175 \times 2}{60} - 1 = 34.73386$, then $\sqrt{\frac{291,3175 \times 2}{60 \times .045} + \frac{34.73386 \times 34.73386}{4} - \frac{34.73386}{2}} = 5\frac{1}{2}$ years the time required.

(81) First $\frac{2}{.06} - \frac{1454,225 \times 2}{250} - 1 = 20,6994$, then $\sqrt{\frac{1454,225 \times 2}{250 \times .06} + \frac{20,6994 \times 20,6994}{4} - \frac{20,6994}{2}} = 7$ years, the time required.

(82) First $\frac{2}{.05} - \frac{188 \times 2}{28} - 1 = 25,572$, then $\sqrt{\frac{188 \times 2}{28 \times .05} + \frac{25,572 \times 25,572}{4} - \frac{25,572}{2}} = 8$ years, the time required.

When the payments are half-yearly, &c.

(83) First $\frac{2}{.025} - \frac{667,5 \times 2}{75} - 1 = 61,2$, then $\sqrt{\frac{667,5 \times 2}{75 \times .025} + \frac{61,2 \times 61,2}{4} - \frac{61,2}{2}} = 10$, the number of payments; hence 5 years is the time required.

(84) First $\frac{2}{.0125} - \frac{671,25 \times 2}{37,5} - 1 = 123,2$, then $\sqrt{\frac{671,25 \times 2}{37,5 \times .0125} + \frac{123,2 \times 123,2}{4} - \frac{123,2}{2}} = 20$, the number of payments; hence 5 years is the time required.

ANNUITIES

ANNUITIES, &c. TAKEN IN REVERSION.

1. To find the present worth of an annuity, taken in reversion.

THEOREM 1. $\frac{tr - tr + 2t}{2tr + 2} \times u = P$, and when P is changed

into A then THEOREM 2. $= \frac{a}{tr + 1} = P$.

(85) First $\frac{5 \times 5 \times .05 - 5 \times .05 + 2 \times 5}{2 \times 5 \times .05 + 2} \times 150 = 660$, then
 $\frac{660}{4 \times .05 + 1} = 550$ l. the present worth required.

(86) First $\frac{4 \times 4 \times .04 - 4 \times .04 + 2 \times 4}{2 \times 4 \times .04 + 2} \times 50 = 182,75862$,
 then $\frac{182,75862}{5 \times .04 + 1} = 152$ l. 5s. 11 $\frac{3}{4}$ d. the present worth of the
 lease required.

(87) First $\frac{8 \times 8 \times .05 - 8 \times .05 + 2 \times 8}{2 \times 8 \times .05 + 2} \times 20 = 134,2857$,
 then $\frac{134,2857}{4 \times .05 + 1} = 111,90475 = 111$ l. 118s. 1d. - 14 = the
 present worth required.

(88) First $\frac{6 \times 6 \times .04 - 6 \times .04 + 2 \times 6}{2 \times 6 \times .04 + 2} \times 40 = 212,904$,
 then $\frac{212,904}{6 \times .04 + 1} = 171,7 = 171$ l. 14s. the present worth.

2. To find the yearly income of an annuity, &c. in reversion.

THEOREM 1. $ptr + p = A$, and when A is changed into P

then THEOREM 2. $= \frac{tr + 1}{tr - tr + 2t} \times 2p = U$.

(89) First $550 \times 4 \times .05 + 550 = 660$, then
 $\frac{5 \times .05 + 1}{5 \times 5 \times .05 - 5 \times .05 + 2 \times 5} \times 2 \times 660 = 150$ l. the yearly
 income.

(90) First

(⁹⁰) First $152,3 \times 5 \times ,04 + 152,3 = 182,76$, then
 $\frac{4 \times ,04 + 1}{4 \times 4 \times ,04 - 4 \times ,04 + 2 \times 4} \times 2 \times 182,76 = 50\%$ the yearly
 income required.

(⁹¹) First $111,90475 \times 4 \times ,05 + 111,90475 = 134,2887$,
 then $\frac{8 \times ,05 + 1}{8 \times 8 \times ,05 - 8 \times ,05 + 2 \times 8} \times 2 \times 134,2887 = 20\%$ the
 yearly rent required.

(⁹²) First $171,7 \times 6 \times ,04 + 171,7 = 212,908$, then
 $\frac{6 \times ,04 + 1}{6 \times 6 \times ,04 - 6 \times ,04 + 2 \times 6} \times 2 \times 212,908 = 40\%$ the
 annuity required.

REBATE OR DISCOUNT.

THEOREM 1. $\frac{s}{ir+1} = P$.

(¹) Here $s = 357,5$. $i = ,75$ and $r = ,05$, whence
 $\frac{357,5}{,75 \times ,05 + 1} = 344,5783 = 344\text{ l. } 11\text{ s. } 6\frac{3}{4}\text{ d. } 168$, *Ans.*

(²) Here $\frac{275,5}{,582 \times ,05 + 1} = 267,69235 = 267\text{ l. } 13\text{ s. } 10\text{ d. } 164$, *Ans.*

(³) Here $\frac{875,275}{,416 \times ,045 + 1} = 859,16589 = 859\text{ l. } 3\text{ s. } 3\frac{3}{4}\text{ d. } 2544$, *Ans.*

(⁴) Here $\frac{75}{1,25 \times ,05 + 1} = 70,5882353 = 70\text{ l. } 11\text{ s. } 9\text{ d. } 176472$, *Ans.*

THEOREM 2. $pir + p = S$.

(⁵) Here $p = 344,5783\text{ l.}$ $i = ,75$, and $r = ,05$, whence
 $344,5783 \times ,75 \times ,05 + 344,5783 = 357,5 = 357\text{ l. } 10\text{ s.}$ *Ans.*

(⁶) Here

Rebate or Discount.

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(6) Here $267,69235 \times ,583 \times ,05 + 267,69235 = 275,5 =$
275l. 10s. Ans.

(7) Here $859,16589 \times ,41\beta \times ,045 + 859,16589 = 875,275$
 $= 875l. 5s. 6d. Ans.$

(8) Here $70,5882353 \times 1,25 \times ,05 + 70,5882353 = 75l.$
Ans.

$$\text{THEOREM 3. } \frac{s-p}{ip} = R.$$

(9) Here $s = 357,5l. p = 344,5783l. \text{ and } r = ,75, \text{ whence}$
 $\frac{357,5 - 344,5783}{344,5783 \times ,75} = ,05, \text{ or } 5l. \text{ the rate per cent.}$

(10) Here $\frac{275,5 - 267,69235}{267,69235 \times ,583} = ,05, \text{ or } 5l. \text{ the rate per}$
 cent.

(11) Here $\frac{875,275 - 859,16589}{859,16589 \times ,41\beta} = ,045, \text{ or } 4\frac{1}{2}l. \text{ the rate}$
 per cent.

(12) Here $\frac{75 - 70,5882353}{70,5882353 \times 1,25} = ,05, \text{ or } 5l. \text{ the rate per}$
 cent.

$$\text{THEOREM 4. } \frac{s-p}{pr} = T.$$

(13) Here $s = 357,5l. p = 344,5783l. \text{ and } r = ,05, \text{ whence}$
 $\frac{357,5 - 344,5783}{344,5783 \times ,05} = ,75 = 9 \text{ months, the time required.}$

(14) Here $\frac{275,5 - 267,69235}{267,69235 \times ,05} = ,583 = 7 \text{ months the time}$
 required.

Q 3

(15) Here

(¹⁵) Here $\frac{875,275 - 859,16589}{859,16589 \times ,045} = ,416 = 5$ months, the time required.

(¹⁶) Here $\frac{75 - 70,5882353}{70,5882353 \times ,05} = 1,25 = 15$ months, the time required.

EQUATION OF PAYMENTS.

THEOREM 1. $\frac{s}{1r+1} = P$. Add all the present worths together, then $s - p = D$, and THEOREM 2. $\frac{d}{pr} = E$, the equated time required.

(¹) Here $\frac{40}{1,0125} = 39,5061$, $\frac{60}{1,025} = 58,5365$, $\frac{100}{1,0375} = 96,3855$, then $200 - 39,5061 + 58,5365 + 96,3855 = 5,5719$, and $\frac{5,5719}{194,4281 \times ,05} = ,57315 = 6$ months and $26,334$ days.

(²) Here $\frac{200}{1,0125} = 197,5308$, $\frac{200}{1,016} = 196,7249$, $\frac{400}{1,025} = 390,2439$, then $800 - 197,5308 + 196,7249 + 390,2439 = 15,5004$, and $\frac{15,5004}{784,4996 \times ,05} = ,395 = 4$ months and $22 +$ days.

(³) The sum paid down $\frac{\text{£. } 200}{}$
 then $\frac{500}{,86 \times ,03 + 1} = 487,804$
 and $\frac{500}{1,6 \times ,03 + 1} = 476,193$
 Sum = $1163,997$, then $1200 - 1163,997 = 36,003$, therefore $\frac{36,003}{1163,997 \times ,03} = 1,031$, or 1 year and 11-16 days.

COM.

COMPOUND INTEREST.

THEOREM 1. $p \times r t = A$.

(1) Here $p = 225$ l. $t = 3$ and $r = 1.05$, whence $1.05^3 = 1.157625$, then $1.157625 \times 225 = 260.465625 = 260$ l. 9 s. $3\frac{3}{4}$ d. the amount required.

(2) First $1.05^4 = 1.21550625$, then $1.21550625 \times 200 = 243.10125 = 243$ l. 2 s. 025 the amount required.

(3) First $1.04^5 = 1.2166529024$, then $1.2166529024 \times 450 = 547.49380608 = 547$ l. 9 s. $10\frac{1}{2}$ d. 0538368, the amount required.

(4) First $1.055^4 = 1.238824650625$, then $1.238824650625 \times 500 = 619.412325312 = 619$ l. 8 s. $2\frac{3}{4}$ d. 8323, the amount required.

THEOREM 2. $\frac{a}{r^t} = P$.

(5) Here $a = 260.465625$ l. $t = 3$, and $r = 1.05$, whence $\frac{260.465625}{1.05^3} = 225$ l. the principal required.

(6) Here $\frac{243.1025}{1.05^4} = 200$ l. the principal required.

(7) Here $\frac{547.49380608}{1.04^5} = 450$ l. the principal required.

(8) Here $\frac{619.42325312}{1.055^4} = 500$ l. the principal required.

THEOREM 3. $\frac{a}{p} = r^t$.

(9) Here $a = 260.465625$ l. $p = 225$ l. and $t = 3$, whence $\frac{260.465625}{225} = 1.157625$, the cube root of which is $= 1.05 = 5$ l. per cent.

(10) Here

(¹⁰) Here $\frac{243,10125}{200} = 1,21550625$, the biquadrate root of which is $1,05 = 5\%$ per cent.

(¹¹) Here $\frac{547,49380608}{450} = 1,2166529024$, the sursolid root of which is $1,04 = 4\%$ per cent.

(¹²) Here $\frac{619,412325312}{500} = 1,238824650625$, the biquadrate root of which is $1,055 = 5\frac{1}{2}\%$ per cent.

THEOREM 4. $\frac{a}{p} = r$

(¹³) Here $a = 260,465625$, $p = 225$, and $r = 1,05$, whence $\frac{260,465625}{225} = 1,15762$, $\frac{1,157625}{1,05} = 1,1025$, $\frac{1,1025}{1,05} = 1,05$ and $\frac{1,05}{1,05} = 1$; here the number of divisions being 3, is the time required.

(¹⁴) First $\frac{243,10125}{200} = 1,21550625$, then $\frac{1,21550625}{1,05} = 1,157625$, $\frac{1,157625}{1,05} = 1,1025$, $\frac{1,1025}{1,05} = 1,05$, and $\frac{1,05}{1,05} = 1$. Here the number of divisions are 4, which is the time required.

(¹⁵) First $\frac{547,49380608}{450} = 1,2166529024$, then $\frac{1,2166529024}{1,04} = 1,16985856$, $\frac{1,16985856}{1,04} = 1,124864$, $\frac{1,124864}{1,04} = 1,0816$, $\frac{1,0816}{1,04} = 1,04$, and $\frac{1,04}{1,04} = 1$; here the number of divisions are 5 which is the time required.

(¹⁶) First

(¹⁶) First $\frac{609,412325312}{500} = 1,238824650625$, then
 $\frac{1,238824650625}{1,055} = 1,174241375$, $\frac{1,174241375}{1,055} = 1,113025$,
 $\frac{1,113025}{1,055} = 1,055$, and $\frac{1,055}{1,055} = 1$; here the number of divisions are 4, which is the time required.

ANNUITIES OR PENSIONS IN ARREARS.

THEOREM 1. $\frac{ur^t - u}{r - 1} = A.$

(¹⁷) Here $u = 50l.$ $t = 4$, and $r = 1,05$, whence
 $\frac{1,05^4 \times 50 - 50}{1,05 - 1} = 215,50625 = 215l. 10s. 1\frac{1}{2}d.$ the amount required.

(¹⁸) Here $\frac{1,05^5 \times 45 - 45}{1,05 - 1} = 248,65340625 = 248l. 13s. 0\frac{1}{4}d. - 27$, the amount required.

(¹⁹) Here $\frac{1,06^6 \times 40 - 40}{1,06 - 1} = 279,012741504 = 279l. 0s. 3d. 05796096$, the amount required.

(²⁰) Here $\frac{1,06^{10} \times 75 - 75}{1,06 - 1} = 988,5596125 + = 988l. 11s. 2\frac{1}{4}d. - 228 +$ the amount required.

THEOREM 2. $\frac{ar - a}{rt - 1} = U.$

(²¹) Here $a = 215,50625l.$ $t = 4$, and $r = 1,05$, whence
 $\frac{215,50625 \times 1,05 - 215,50625}{1,05^4 - 1} = 50l.$ the annuity required.

Here (²²)

(²²) Here $\frac{248,65340625 \times 1,05 - 248,65340625}{1,05^3 - 1} = 45l.$
the pension required.

(²³) Here $\frac{279,012741504 \times 1,06 - 279,012741504}{1,06^6 - 1} =$
40l. the salary required.

(²⁴) Here $\frac{988,5596125 \times 1,06 - 988,5596125}{1,06^{10} - 1} = 75l.$
the annuity required.

THEOREM 3. $\frac{ar + u - a}{u} = r^t.$

(²⁵) Here $a = 215,50625l.$ $u = 50l.$ and $r = 1,05$, whence
 $\frac{215,50625 \times 1,05 + 50 - 215,50625}{50} = 1,21550615$, which
being continually divided by r , the number of those divisions
will be 4 years, the time required.

(²⁶) Here $\frac{248,65340625 \times 1,05 + 45 - 248,65340625}{45} =$
 $1,27628 +$ which being continually divided by r , the num-
ber of those divisions will be 5 years, the time required.

(²⁷) Here $\frac{279,012741504 \times 1,06 + 40 - 279,012741504}{40} =$
 $1,418519 +$ which being divided continually by r , the
number of those divisions will be 6 years, the time required.

(²⁸) Here $\frac{988,5596125 \times 1,06 + 75 - 988,5596125}{75} =$
 $1,79084 +$ which being divided continually by r , the num-
ber of those divisions will be 10 years, the time required.

PRESENT

PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

$$\text{THEOREM 1. } \frac{u - \frac{u}{r^t}}{r - 1} = P.$$

(²⁹) Here $u=30l.$ $t=7$ and $r=1.06$, whence $\frac{30}{1.06^7} = 19.9517$, then $30 - 19.9517 = 10.0483$, and $\frac{10.0483}{1.06 - 1} = 167.4716 = 167l. 9s. 5d. - 184$, the present worth required.

(³⁰) First $40 - \frac{40}{1.05^8} = 12.926326$, then $\frac{12.926326}{1.05 - 1} = 258.52652 = 258l. 10s. 6\frac{1}{4}d. - 4592$ the present worth required.

(³¹) First $35 - \frac{35}{1.06^7} = 11.723$, then $\frac{11.723}{1.06 - 1} = 195.382 = 195l. 7s. 7\frac{3}{4}d. - 968$ the present worth required.

(³²) First $50 - \frac{50}{1.05^5} = 10.82365$, then $\frac{10.82365}{1.05 - 1} = 216.473 = 216l. 9s. 5\frac{1}{2}d. - 08$ the answer required.

$$\text{THEOREM 2. } \frac{prt \times r - prt}{r - 1} = U.$$

(³³) Here $p=167.4716l.$ $t=7$ and $r=1.06$, whence $\frac{167.4716 \times 1.06^7 \times 1.06 - 167.4716 \times 1.06^7}{1.06^7 - 1} = 30l.$ the annuity required.

(³⁴) Here $\frac{258.52652 \times 1.05^8 \times 1.05 - 258.52652 \times 1.05^8}{1.05^8 - 1} = 40l.$ the salary required.

(³⁵) Here

(³³) Here $\frac{195,383 \times 1,06^7 \times 106 - 195,383 \times 1,06^7}{1,06^7 - 1} = 35$,
the pension required.

(³⁴) Here $\frac{216,473 \times 1,05^5 \times 1,05 - 216,473 \times 1,05^5}{1,05^5 - 1} =$
50, the annuity required.

THEOREM 3. $\frac{u}{p+u-pr} = rt$.

(³⁵) Here $p=167,4716$, $u=30$ and $r=1,06$, whence
 $\frac{30}{167,4716+30-167,4716 \times 1,06} = 1,50363$, which being
continually divided, the number of those divisions will be
found = 7 years, the time required.

(³⁶) Here $\frac{40}{258,52652+40-258,52652 \times 1,05} = 1,47745$
which being continually divided by r , the number of those divi-
sions will be found = 8 years, the time required.

(³⁷) Here $\frac{35}{195,383+35-195,383 \times 1,06} = 1,50363$,
which being divided continually by r , the number of those divi-
sions will be found = 7 years, the time required.

(³⁸) Here $\frac{50}{216,473+50-216,473 \times 1,05} = 1,27628$,
which being divided continually by r , the number of those divi-
sions will be found = 5 years, the time required.

ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

1. To find the present worth of Annuities, Leases, &c. taken in
reversion.

$$\frac{u}{r^t}$$

THEOREM 1. $\frac{u}{r-1} = P$, and when P is changed into A then

THEOREM 2. $= \frac{a}{r^t} = P$ the present worth.

(⁴¹) First

(⁴¹) First $40 - \frac{40}{1,06^6} = 11,8016$, then $\frac{11,8016}{1,06 - 1} = 196,693$,
and $\frac{196,693}{1,06^2} = 175,0563 = 175\text{l. } 1\text{s. } 1\frac{1}{2}\text{d.} - 048$, the present
worth required.

(⁴²) First $60 - \frac{60}{1,05^7} = 17,3592$, then $\frac{17,3592}{1,05 - 1} = 347,184$
and $\frac{347,184}{1,05^3} = 299,91188 = 299\text{l. } 18\text{s. } 2\frac{3}{4}\text{d.} - 4048$, the
present worth required.

(⁴³) First $30 - \frac{30}{1,05^7} = 8,6796$, then $\frac{8,6796}{1,05 - 1} = 173,592$ and
 $\frac{173,592}{1,05^4} = 142,8153 = 142\text{l. } 16\text{s. } 3\frac{1}{2}\text{d.} - 688$, the present
worth required.

2. To find the yearly income of an annuity, &c. taking in
reversion.

THEOREM 1. $prt = A$. And when A is changed into P, then

$$\text{THEOREM 2. } = \frac{prt \times r - prt}{rt - 1} = U.$$

(⁴⁴) First $175,0563 \times 1,06^2 = 196,693$, then
 $\frac{196,693 \times 1,06^6 \times 1,06 - 196,693 \times 1,06^6}{1,06^6 - 1} = 40\text{l.}$ the annuity
required.

(⁴⁵) First $299,91188 \times 1,05^3 = 347,184$, then
 $\frac{347,184 \times 1,05^7 \times 1,05 - 347,184 \times 1,05^7}{1,05^7 - 1} = 60\text{l.}$ the yearly
rent required.

(⁴⁶) First $142,8152 \times 1,05^4 = 173,592$, then
 $\frac{173,592 \times 1,05^7 \times 1,05 - 173,592 \times 1,05^7}{1,05^7 - 1} = 30\text{l.}$ the yearly
rent required.

R

PURCHASING

PURCHASING FREEHOLD OR REAL ESTATES, SUCH AS
ARE BOUGHT TO CONTINUE FOR EVER.

$$\text{THEOREM 1. } \frac{u}{r-1} = W.$$

(⁴⁷) Here $u=50$ l. and $r=1,05$, then $\frac{50}{1,05-1}=1000$ l.
the answer.

(⁴⁸) Here $\frac{140}{1,04-1}=3500$ l. the worth of the estate in pre-
sent money.

(⁴⁹) Here $\frac{75}{1,06-1}=1250$ l. the worth of the estate in
present money.

$$\text{THEOREM 2. } w \times r - 1 = U.$$

(⁵⁰) Here $w=1000$ l. and $r=1,05$, then $1,05-1 \times 1000$
 $=50$ l. the yearly rent.

(⁵¹) Here $1,04-1 \times 3500=140$ l. the yearly rent re-
quired.

(⁵²) Here $1,06-1 \times 1250=75$ l. the yearly rent required.

$$\text{THEOREM 3. } \frac{w+u}{w} = R.$$

(⁵³) Here $w=1000$ l. and $u=50$ l. whence $\frac{1000+50}{1000}=1,05=5$ l. the rate per cent.

(⁵⁴) Here $\frac{3500+140}{3500}=1,04=4$ l. the rate per cent.

(⁵⁵) Here $\frac{1250+75}{1250}=1,06=6$ l. the rate per cent.

PURCHASING FREEHOLD ESTATES IN REVERSION.

1. To find the worth of a freehold estate in reversion.

$$\text{THEOREM 1. } \frac{u}{r-1} = W, \text{ and when } W \text{ is changed into } A,$$

$$\text{then THEOREM 2. } \frac{a}{r^t} = P.$$

(⁵⁵) First

(⁵⁶) First $\frac{50}{1.05 - 1} = 1000$, then $\frac{1000}{1.05^4} = 822.7067 =$
 822*l.* 14*s.* 1½*d.* - 432, *Ans.*

(⁵⁷) First $\frac{200}{1.04 - 1} = 5000$, then $\frac{5000}{1.04^2} = 4622.781 =$
 4622*l.* 15*s.* 7*d.* - 44, *Ans.*

(⁵⁸) First $\frac{240}{1.06 - 1} = 4000$, then $\frac{4000}{1.06^3} = 3358.494 =$
 3358*l.* 9*s.* 10½*d.* - 24, *Ans.*

2. To find the yearly rent of an estate taken in reversion.

THEOREM 1. $wrt = A$. And when A is changed into W' then THEOREM 2. $= wr - w = U$.

(⁵⁹) First $822.7067 \times 1.05^4 = 1000$, then $1000 \times 1.05 - 1000 = 50*l.*$ *Ans.*

(⁶⁰) First $4622.781 \times 1.04^2 = 5000$, then $5000 \times 1.04 - 5000 = 200*l.*$ *Ans.*

(⁶¹) First $3358.494 \times 1.06^3 = 4000$, then $4000 \times 1.06 - 4000 = 240*l.*$ *Ans.*

REBATE OR DISCOUNT.

THEOREM 1. $\frac{s}{r^t} = P$.

(¹) Here $s = 315.6175$, $t = 4$ and $r = 1.06$, whence
 $\frac{315.6175}{1.06^4} = 250*l.*$ the present worth required.

(²) Here $\frac{344.7395}{1.05^7} = 245*l.*$ the present worth required.

(³) Here $\frac{441.8645}{1.06^6} = 350*l.*$ the sum the creditor must receive.

THEOREM 2. $p \times r^t = S$.

(⁴) Here $p = 250$ l. $t = 4$, and $r = 1.06$, whence $250 \times 1.06^4 = 315.6175 = 315$ l. 12s. 4d. - 2, the sum due.

(⁵) Here $245 \times 1.05^7 = 344.7395 = 344$ l. 14s. 9 $\frac{1}{4}$ d. - 92, the debt.

(⁶) Here $350 \times 1.06^4 = 441.8645 = 441$ l. 17s. 3 $\frac{1}{4}$ d. - 92 the debt.

THEOREM 3. $\frac{S}{p} = r^t$.

(⁷) Here $S = 315.6175$, $p = 250$ and $r = 1.06$, whence $\frac{315.6175}{250} = 1.26247$, which being continually divided, those divisions will be equal to 7, the number of years required.

(⁸) Here $\frac{344.7395}{245} = 1.4071$, which being continually divided, those divisions will be equal to 7, the number of years required.

(⁹) Here $\frac{441.8645}{350} = 1.26247$, which being continually divided, those divisions will be equal to 4, the number of years required.

THEOREM 4. $\frac{S}{p} = r^t$.

(¹⁰) Here $S = 315.6175$, $p = 250$, and $t = 4$, whence $\frac{315.6175}{250} = 1.26247$, then $\sqrt[4]{1.26247} = 1.06 = 6$ l. the rate per cent.

(¹¹) Here $\frac{344.7395}{245} = 1.4071$, then $\sqrt[7]{1.4071} = 1.05 = 5$ l. the rate per cent.

(¹²) Here $\frac{441.8645}{350} = 1.26247$, then $\sqrt[4]{1.26247} = 1.06 = 6$ l. the rate per cent.

PART IV.

DUODECIMALS:

OR, WHAT IS GENERALLY CALLED

Cross Multiplication, and squaring of Dimensions by Artificers and Workmen.

$$\begin{array}{r} \text{F. in. p.} \\ (1) \quad 7 \times 9 \\ \quad \quad 3 \times 6 \\ \hline 21 \quad 0 \quad 0 \\ 2 \quad 3 \quad 0 \\ 3 \quad 6 \quad 0 \\ 0 \quad 4 \quad 6 \\ \hline \text{Ans. } 27 \quad 1 \quad 6 \end{array}$$

$$\begin{array}{r} \text{F. in. p.} \\ (2) \quad 8 \times 5 \\ \quad \quad 4 \times 7 \\ \hline 32 \quad 0 \quad 0 \\ 1 \quad 8 \quad 0 \\ 4 \quad 6 \quad 0 \\ 0 \quad 2 \quad 11 \\ \hline \text{Ans. } 38 \quad 6 \quad 11 \end{array}$$

$$\begin{array}{r} \text{F. in.} \\ (3) \quad 9 \times 8 \\ \quad \quad 7 \times 6 \\ \hline 63 \quad 0 \\ 4 \quad 8 \\ 4 \quad 6 \\ 0 \quad 4 \\ \hline \text{Ans. } 72 \quad 6 \end{array}$$

$$\begin{array}{r} \text{F. in. p.} \\ (4) \quad 8 \times 1 \\ \quad \quad 3 \times 5 \\ \hline 24 \quad 0 \quad 0 \\ 0 \quad 3 \quad 0 \\ 3 \quad 4 \quad 0 \\ 0 \quad 0 \quad 5 \\ \hline \text{Ans. } 27 \quad 7 \quad 5 \end{array}$$

$$\begin{array}{r} \text{F. in. p.} \\ (5) \quad 7 \times 6 \\ \quad \quad 5 \times 9 \\ \hline 35 \quad 0 \quad 0 \\ 2 \quad 6 \quad 0 \\ 5 \quad 3 \quad 0 \\ 0 \quad 4 \quad 6 \\ \hline \text{Ans. } 43 \quad 1 \quad 6 \end{array}$$

$$\begin{array}{r} \text{F. in. p.} \\ (6) \quad 4 \times 7 \\ \quad \quad 3 \times 10 \\ \hline 12 \quad 0 \quad 0 \\ 1 \quad 9 \quad 0 \\ 3 \quad 4 \quad 0 \\ 0 \quad 5 \quad 10 \\ \hline \text{Ans. } 17 \quad 6 \quad 10 \end{array}$$

R 3

(7) 7

$$\begin{array}{r}
 \text{F. in. p.} \\
 (7) \quad 7 \quad 5 \quad 9 \quad \text{m m} \\
 \quad \quad 3 \quad 5 \quad 3 \\
 \hline
 \quad 22 \quad 5 \quad 3 \\
 \quad \quad 3 \quad 1 \quad 4 \quad 9 \\
 \quad \quad \quad 1 \quad 10 \quad 5 \quad 3 \\
 \hline
 \text{Ans. } 25 \quad 8 \quad 6 \quad 2 \quad 3
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (8) \quad 10 \quad 4 \quad 5 \quad \text{m m} \\
 \quad \quad 7 \quad 8 \quad 6 \\
 \hline
 \quad 72 \quad 6 \quad 11 \\
 \quad \quad 6 \quad 10 \quad 11 \quad 4 \\
 \quad \quad \quad 5 \quad 2 \quad 2 \quad 6 \\
 \hline
 \text{Ans. } 79 \quad 11 \quad 0 \quad 6 \quad 6
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (9) \quad 75 \quad 7 \\
 \quad \quad 9 \quad 8 \\
 \hline
 \quad 680 \quad 3 \\
 \quad \quad 50 \quad 4 \quad 8 \\
 \hline
 \text{Ans. } 730 \quad 7 \quad 8
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \\
 (10) \quad 97 \quad 8 \\
 \quad \quad 8 \quad 9 \\
 \hline
 \quad 781 \quad 4 \\
 \quad \quad 73 \quad 3 \\
 \hline
 \text{Ans. } 854 \quad 7
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (11) \quad 57 \quad 9 \\
 \quad \quad 9 \quad 5 \\
 \hline
 \quad 519 \quad 9 \\
 \quad \quad 24 \quad 0 \quad 9 \\
 \hline
 \text{Ans. } 543 \quad 9 \quad 9
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (12) \quad 75 \quad 9 \\
 \quad \quad 17 \quad 7 \\
 \hline
 \quad 1287 \quad 9 \\
 \quad \quad 44 \quad 2 \quad 3 \\
 \hline
 \text{Ans. } 1331 \quad 11 \quad 3
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (13) \quad 87 \quad 5 \\
 \quad \quad 35 \quad 8 \\
 \hline
 \quad 3059 \quad 7 \\
 \quad \quad 58 \quad 3 \quad 4 \\
 \hline
 \text{Ans. } 3117 \quad 10 \quad 4
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (14) \quad 179 \quad 3 \\
 \quad \quad 38 \quad 10 \\
 \hline
 \quad 6811 \quad 6 \\
 \quad \quad 49 \quad 4 \quad 8 \\
 \hline
 \text{Ans. } 6960 \quad 10 \quad 6
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (15) \quad 259 \quad 2 \\
 \quad \quad 48 \quad 11 \\
 \hline
 \quad 12440 \quad 0 \\
 \quad \quad 237 \quad 6 \quad 10 \\
 \hline
 \text{Ans. } 12677 \quad 6 \quad 10
 \end{array}$$

$$\begin{array}{r}
 \text{F. in. p.} \\
 (16) \quad 257 \quad 9 \\
 \quad \quad 39 \quad 11 \\
 \hline
 \quad 10552 \quad 3 \\
 \quad \quad 236 \quad 3 \quad 3 \\
 \hline
 \text{Ans. } 10288 \quad 6 \quad 3
 \end{array}$$

F. in. p.	F. in. p.
(17) $\begin{array}{r} 311\ 4\ 7 \\ \underline{36\ 7\ 5} \\ 11209\ 9\ 0 \\ 181\ 7\ 8\ 1 \\ \underline{10\ 9\ 8\ 10\ 11} \\ \text{Ans. } 11402\ 2\ 4\ 11\ 10 \end{array}$	(18) $\begin{array}{r} 321\ 7\ 3 \\ \underline{9\ 3\ 6} \\ 2894\ 5\ 3 \\ 80\ 4\ 9\ 9 \\ \underline{13\ 4\ 9\ 7\ 6} \\ \text{Ans. } 2988\ 2\ 10\ 4\ 6 \end{array}$

NOTE. Any question in this Rule may be proved by Vulgar Fractions, Decimals, or Practice; as an instance, let the first Example be resumed.

1. By Vulgar Fractions.

$$\begin{array}{l} f. in. \\ 7\ 9 = 7\frac{9}{12} = 7\frac{3}{4} ft. \\ 3\ 6 = 3\frac{6}{12} = 3\frac{1}{2} ft. \end{array}$$

Then $7\frac{3}{4} \times 3\frac{1}{2} = 27\frac{1}{2} = 27\ f. 1\ in. 6\ p. \text{ Ans.}$

2. By Decimals.

$$\begin{array}{r} f. in. f. \\ 7\ 9 = 7.75 \\ 3\ 6 = 3.5 \\ \hline 3875 \\ 2325 \\ \hline 27.125 = 27\ f. 1\ in. 6\ p. \text{ Ans.} \end{array}$$

3. By Practice.

$$\begin{array}{r} in. f. in. p. \\ 6\frac{1}{2}) 7\ 9 \\ \underline{3\ 6} \\ 23\ 3 \\ \underline{3\ 10\ 6} \\ 27\ 1\ 6 \text{ Ans.} \end{array}$$

Another very good method of proving and performing this rule, is done by reducing the factors into inches, and dividing their

their product by the inches in a square foot, viz. 144; the quotient will be the answer. But if the factors have a denomination of seconds, reduce them to that name, and divide their product by the seconds in a square foot, viz. 20736, for the answer.

THE APPLICATION.

1. *Measuring by the foot square, as Glaziers' and Masons' flat-work.*

$$\begin{array}{r}
 \text{f.} \quad \text{in.} \\
 \text{(19) First } 7 \quad 10 \quad \left. \begin{array}{l} \text{the} \\ 6 \quad 8 \quad \text{heights} \\ 5 \quad 4 \quad \text{added.} \end{array} \right\} \\
 \hline
 19 \quad 10 \quad \text{sum} \\
 \hline
 3 = \text{windows.} \\
 \hline
 59 \quad 6 \quad \text{in a tier.} \\
 \hline
 3 \quad 11 \quad \text{in a breadth.} \\
 \hline
 178 \quad 6 \\
 \hline
 54 \quad 6 \quad 6 \\
 \hline
 233 \quad 0 \quad 6 \quad \text{whole superficies.} \\
 \hline \hline
 \end{array}$$

$$\begin{array}{r}
 \text{f.} \quad \text{in.} \quad \text{p.} \\
 \text{Then } 233 \quad 0 \quad 6 \quad \text{at } 4d. \text{ per foot.} \\
 \hline
 2d. - \frac{1}{6}) 233 \quad \quad \quad = 1s. \\
 \quad 38 \quad 10 \quad \quad \quad = 2d. \\
 \quad \quad c \frac{1}{2} \quad \quad \quad = 6 \text{ pts.} \\
 \hline
 2 \mid 0 \mid 27 \mid 1 \quad 1 \frac{1}{2} \\
 \hline
 \underline{\underline{£.13 \quad 11 \quad 10 \frac{1}{2} \text{ Ans.}}}
 \end{array}$$

$$\begin{array}{r}
 \text{f.} \quad \text{in.} \quad \text{p.} \\
 \text{(20) First } 4 \quad 10 \quad = \text{length.} \\
 \quad 2 \quad 11 \quad = \text{breadth.} \\
 \hline
 9 \quad 8 \\
 \hline
 4 \quad 5 \quad 2 \\
 \hline
 14 \quad 1 \quad 2 = \text{superficies of one square} \\
 \hline
 8 \\
 \hline
 112 \quad 9 \quad 4 = \text{eight ditto.} \\
 \hline \hline
 \end{array}$$

Then

Then $4\frac{1}{3}$ 11 2 9 4 at $4\frac{1}{2}d.$ per foot.

$$\begin{array}{r} 37 \quad 4 \quad = 4d. \\ 4 \quad 8 \quad = \frac{1}{2} qrs. \\ 3\frac{1}{2} \quad = 9 inches. \\ \hline 2|0)4|2 \quad 3\frac{1}{2} + \\ \hline \underline{\underline{£.2 \quad 2 \quad 3\frac{1}{2} + Ans.}} \end{array}$$

(²¹) First $f. in.$
 $1 \quad 6 = \text{width.}$
 $3 = \text{height.}$
 $4 \quad 6 = \text{one window.}$
 8
 $36 \quad 0 = \text{eight ditto.}$

Then $36f.$ at $7\frac{1}{4}d.$ per foot, comes to $1l. 3s. 3d.$ *Ans.*

(²²) First $f. in. p.$
 $5 \quad 7 \quad = \text{length.}$
 $1 \quad 10 \quad = \text{breadth.}$
 $5 \quad 7$
 $4 \quad 7 \quad 10$

$10 \quad 2 \quad 10 = \text{superficies of the slab, which at } 6s. \text{ per foot, comes to } 3l. 1s. 5d. \text{ the } Ans.$

2. Measuring by the yard square, as Paviers, Painters, Plasterers, and Joiners.

(²³) First $f. in. p.$
 $74 \quad 9 \quad = \text{length.}$
 $11 \quad 6 \quad = \text{width.}$

$$\begin{array}{r} 822 \quad 3 \\ 37 \quad 4 \quad 6 \\ \hline 859 \quad 7 \quad 6 = \text{superficies of the room.} \end{array}$$

Then $859f. 7 in. 6 p.$ after the rate of $3s. 10\frac{1}{2}d.$ per yard, comes to $18l. 10s. 1\frac{1}{4}d. + Ans.$

(²⁴) First

	<i>f.</i>	<i>in.</i>	<i>p.</i>	
(²⁴) First	58	6		=length.
	54	9		=breadth.
	<hr/>			
	3159	0		
	43	10	6	
	<hr/>			
	3202	10	6	=area of the yard.
	<hr/>			

Then 3202 *f.* 10 *in.* 6 *p.* after the rate of $4\frac{1}{4}d.$ per yard, comes to 7*l.* 0*s.* $10\frac{1}{4}d.$ + *Ans.*

	<i>f.</i>	<i>in.</i>	<i>p.</i>	
(²⁵) First	97	8		=compass.
	9	10		=height.
	<hr/>			
	879	0		
	81	4	8	
	<hr/>			
	960	4	8	=superficies.
	<hr/>			

Then 960 *f.* 4 *in.* 8 *p.* after the rate of 2*s.* $8\frac{1}{2}d.$ per yard, comes to 14*l.* 11*s.* $2\frac{1}{2}d.$ + *Ans.*

	<i>f.</i>	<i>in.</i>	<i>p.</i>	
(²⁶) First	8	3		=length.
	6	6		=breadth.
	<hr/>			
	49	6		
	4	1	6	
	<hr/>			
	53	7	6	=5 yds. 8 <i>f.</i> 7 <i>in.</i> 6 <i>p.</i> content.
	<hr/>			

Then 5 yds. 8 *f.* 7 *in.* 6 *p.* at 6*s.* $7\frac{1}{2}d.$ per yard, comes to 1*l.* 19*s.* $5\frac{1}{2}d.$ + *Ans.*

	<i>f.</i>	<i>in.</i>	<i>p.</i>	
(²⁷) First	27	10		=length.
	14	9		=breadth.
	<hr/>			
	389	8		
	20	10	6	
	<hr/>			
	410	6	6	=45 yds. 5 <i>f.</i> 6 <i>in.</i> 6 <i>p.</i> area.
	<hr/>			

Then 45 yds. 5 *f.* 6 *in.* 6 *p.* at 3*s.* 2*d.* per yard, comes to 7*l.* 4*s.* $5\frac{1}{4}d.$ + *Ans.*

(²⁸) First

(²⁸) First $\begin{array}{r} f. \text{ in.} \\ 68 \text{ } 6 \end{array} = \text{length.}$
 $\begin{array}{r} 5 \text{ } 6 \end{array} = \text{breadth.}$
 $\begin{array}{r} 342 \text{ } 6 \\ 34 \text{ } 3 \\ \hline 376 \text{ } 9 \end{array} = 41,861 \text{ yds.} = \text{area of the foot-way.}$

Then 41,861 yds. at 3s. 6d. per yard, comes to 146,51s.

Again $\begin{array}{r} f. \text{ in. } p. \\ 42 \text{ } 9 \end{array} = \text{front.}$
 $\begin{array}{r} 68 \text{ } 6 \end{array} = \text{depth.}$
 $\begin{array}{r} 2907 \text{ } 0 \\ 21 \text{ } 4 \text{ } 6 \\ \hline 2928 \text{ } 4 \text{ } 6 \end{array} = \text{area of the court-yard.}$
 $\begin{array}{r} 376 \text{ } 9 \text{ } 0 \end{array} = \text{area of the foot-way.}$

Diff. $\begin{array}{r} 2551 \text{ } 7 \text{ } 6 \end{array} = 283,54 \text{ yds.}$

Then 283,54 yds. at 3s. per yard, comes to 850,54s.

Whence 850,54s. + 146,51s. = 997,05 = 49l. 17s. 0½d. +
Ans.

(²⁹) First $\begin{array}{r} f. \text{ in. } p. \\ 21 \text{ } 8 \end{array} = \text{length.}$
 $\begin{array}{r} 14 \text{ } 10 \end{array} = \text{breadth.}$
 $\begin{array}{r} 303 \text{ } 4 \\ 18 \text{ } 0 \text{ } 8 \\ \hline 321 \text{ } 4 \text{ } 8 \end{array} = 35,709 \text{ yds.}$

Then 35,709 yds. × 10d. = 357,09d. = 1l. 9s. 9d. + *Ans.*

(³⁰) First $\begin{array}{r} f. \text{ in.} \\ 83 \text{ } 8 \end{array} = \text{height}$
 $\begin{array}{r} 12 \text{ } 6 \end{array} = \text{compass}$ } of the room.
 $\begin{array}{r} 1004 \text{ } 0 \\ 41 \text{ } 10 \\ \hline 1045 \text{ } 10 \end{array} = 116,2037 \text{ yds. then } 116,2037 \times 6 = 697,2222 \text{ s.}$

Again

Again $\begin{array}{r} f. \text{ in.} \\ 7 \quad 3 = \text{height} \\ 3 \quad 6 = \text{breadth} \end{array} \left. \vphantom{\begin{array}{r} f. \text{ in.} \\ 7 \quad 3 \\ 3 \quad 6 \end{array}} \right\} \text{ of the shutters.}$

$$\begin{array}{r} 23 \quad 0 \\ 3 \quad 10 \\ \hline 26 \quad 10 \end{array}$$

$\begin{array}{r} 26 \quad 10 \\ 3 \quad 10 \\ \hline 26 \quad 10 \end{array} = \text{surface of one shutter.}$

$\begin{array}{r} 2) 80 \quad 6 \\ 40 \quad 3 \end{array} = \text{surface of three ditto.}$

$40 \quad 3 = \text{half work} = 4,47\frac{1}{2} \text{ yds. then } 4,47\frac{1}{2} \times 6 = 26,83s.$

Once more $\begin{array}{r} f. \text{ in.} \\ 3 \quad 6 = \text{height} \\ 7 \quad 0 = \text{breadth} \end{array} \left. \vphantom{\begin{array}{r} f. \text{ in.} \\ 3 \quad 6 \\ 7 \quad 0 \end{array}} \right\} \text{ of the door.}$

$$\begin{array}{r} 2) 24 \quad 6 \\ 12 \quad 3 \end{array}$$

$12 \quad 3 = \text{half work} = 1,36\frac{1}{2} \text{ yd. then } 1,36\frac{1}{2} \times 6 = 8,173s.$

Lastly $697,222s. + 26,83s. + 8,173s. = 732,228s. = 36l. 12s. 2\frac{1}{2}d. + \text{Ans.}$

3. Measuring by the square of 100 feet, as Flooring, Partitioning, Roofing, Tiling, &c.

(31) Here $\begin{array}{r} f. \text{ in. p.} \\ 173 \quad 10 \\ 10 \quad 7 \end{array} \left. \vphantom{\begin{array}{r} f. \text{ in. p.} \\ 173 \quad 10 \\ 10 \quad 7 \end{array}} \right\} \begin{array}{l} = \text{length} \\ = \text{breadth} \end{array} \text{ of the partitioning.}$

$$\begin{array}{r} 1738 \quad 4 \\ 101 \quad 4 \quad 10 \\ \hline 1839 \quad 8 \quad 10 \end{array}$$

$1839 \quad 8 \quad 10 = 18 \text{ squares } 39f. 8 \text{ in. } 10p. \text{ Ans.}$

$\begin{array}{r} f. \text{ in.} \\ 20 \quad 8 = \text{length} \\ 16 \quad 9 = \text{breadth} \end{array} \left. \vphantom{\begin{array}{r} f. \text{ in.} \\ 20 \quad 8 \\ 16 \quad 9 \end{array}} \right\} \text{ of the house.}$

$$\begin{array}{r} 330 \quad 8 \\ 15 \quad 6 \\ \hline 346 \quad 2 \end{array}$$

$346 \quad 2 = \text{surface of the first floor.}$

$$\begin{array}{r} 4 \\ 1384 \quad 8 \end{array}$$

$1384 \quad 8 = \text{surface of them all;}$

4 feet

F. in.

4 6=breath } of the first fire-place.
6 0=length }

27 0=its surface.

2

54 0=surface of the first two ditto.

F. in.

5 4=breath } of the second fire-place.
6 0=length }

32 0=its surface.

2

64 0=surface of the second two ditto.

F. in. p.

5 8=length } of the third fire-place.
4 8=breath }

22 8

3 9 4

26 5 4=its surface.

2

52 10 8=surface of the third two ditto.

F. in.

5 2=length } of the seventh fire-place.
4 0=breath }

20 8=its surface.

F. in. p.

10 6=length } of the well-hole.
8 9=breath }

84 0

7 10 6

91 10 6=area of it at the ground-floor.

4

367 6 0=the quantity of area taken up by the well-hole.

F.	in.	p.	
367	6	0	} the different areas.
54	0	0	
64	0	0	
52	10	8	
20	8	0	
<u>559</u>	<u>0</u>	<u>8</u>	= the sum of the areas of the fire-places, &c.

Whence $1384\text{ f. } 8\text{ in.} - 559\text{ f. } 0\text{ in. } 8\text{ p.} = 825\text{ f. } 7\text{ in. } 4\text{ p.}$
 $= 8\text{ sq. } 25\text{ f. } 7\text{ in. } 4\text{ p.}$ which at $6\text{ l. } 10\text{ s.}$ per square, comes to $53\text{ l. } 13\text{ s. } 3\frac{1}{2}\text{ d.}$ the answer required.

F.	in.	
(³³) First 52	8 = length	} of the house.
30	6 = breadth	
<u>1580</u>	0	
26	4	
<u>1606</u>	4 = area within the walls.	
803	2 = half ditto.	

Sum $2409\text{ f. } 6 = 24,095\text{ sq.}$ then $24,095 \times 10\frac{1}{2}\text{ s.} =$
 $252,9975\text{ s.} = 12\text{ l. } 12\text{ s. } 11\frac{3}{4}\text{ d.}$ + the answer required.

	F.	in.	p.	
(³⁴) First	43	10	=length	} of the barn.
	27	5	=breadth	
	<u>1183</u>	6		
	18	3	2	
	<u>1201</u>	9	2	=the area.
	600	10	7	=half ditto.
	<u>1802</u>	7	9	=surf.
	116	10	8	add.
Sum	<u>1919</u>	<u>6</u>	<u>5</u>	=19,19534 s. sq.

Secondly 43	10 = length	} of eave boards.
2	8 = breadth	
<u>87</u>	8	
29	2	8
<u>116</u>	<u>10</u>	<u>8</u> = surface of eave boards.

Then

Then $19,19534\beta \times 25\frac{1}{2} = 489,4813r = 24l. 9r. 5\frac{1}{2}d. +$ the answer required.

4. Measuring by the Rod.

(³⁵) First $\frac{4085 \times 5}{3} = 6808,3$, then $\frac{6808,3}{272,25} = 25 + \text{rods,}$
the Ans.

F. in.
(³⁶) First $\begin{array}{r} 254 \ 0 \\ 12 \ 7 \end{array}$

$\begin{array}{r} 3048 \ 0 \\ 148 \ 2 \end{array}$

Sum $3196 \ 2 = 3196,1\beta =$ the area, then

$\frac{3196,1\beta \times 6}{3} = 6392,3$, and $\frac{6392,3}{272,25} = 23 \text{ rods. } 130 \text{ f. } 6 \text{ in.}$
11 p. 52, Ans.

F. in.
(³⁷) First $\begin{array}{r} 62 \ 6 \\ 14 \ 8 \\ 875 \ 0 \\ 41 \ 8 \end{array}$

Sum $916 \ 8 = 916,8 =$ the area, then

$\frac{916,8 \times 5}{3} = 1527,7$, and $\frac{1527,7}{272,25} = 5 \text{ rods. } 166 \text{ f. } 5 \text{ in.} +$
the answer required.

F. in.
(³⁸) First $\begin{array}{r} 28 \ 10 \\ 20 \ 0 \end{array}$

Prod. $576 \ 8 = 576,8 \text{ f.}$

Then $\frac{576,8 \times 5}{3} = 961,7 =$ area of the first height.

$$\begin{array}{r} \text{Secondly } \overset{f. \text{ in.}}{28 \text{ } 0} \\ \underline{20 \text{ } 0} \end{array}$$

$$\text{Prod. } \underline{576 \text{ } 8} = 576, 8 f.$$

$$\text{Then } \frac{576, 8 \times 4}{3} = 768, 8 = \text{area of the second height.}$$

$$\begin{array}{r} \text{Th'rdly } \overset{f. \text{ in.}}{28 \text{ } 10} \\ \underline{15 \text{ } 8} \\ 432 \text{ } 6 \\ \underline{19 \text{ } 2 \text{ } 8} \end{array}$$

$$\text{Sum } \underline{451 \text{ } 8 \text{ } 8} = 451, 7 f. = \text{area of the third height.}$$

$$\begin{array}{r} \text{Fourthly } \overset{f. \text{ in.}}{28 \text{ } 10} \\ \underline{10 \text{ } 6} \\ 288 \text{ } 4 \\ \underline{14 \text{ } 5} \end{array}$$

$$\text{Sum } 302 \text{ } 9 = 302, 75 f.$$

$$\text{Then } \frac{302, 75 \times 2}{3 \times 2} = 100, 91 \beta \text{ area of the gable-end.}$$

$$\begin{array}{r} \text{Then } \overset{f.}{961, 11 x} \\ 768, 88 \beta \\ 451, 72 f. \\ \underline{100, 91 \beta} \end{array}$$

$2282, 638 =$ the sum of the areas, which divided by $272, 25$ gives $8, 384348$ rods, and $8, 384348 \times 5, 8 l. = 48, 6292184 l. = 48 l. 12 s. 7 d. +$ the answer required.

5. How to multiply several figures by several, and the product to be produced in one line only.

(1) Multiply 35234

By 52424

$$\text{Prod. } \underline{\underline{1847107216}}$$

First, $4 \times 4 = 16$, that is 6 and carry 1. *Seco.*, $3 \times 4 + 4 \times 2$, and 1 that is carried is 21; set down 1 and carry 2. *Third'y*, $2 \times 4 + 3 \times 2 + 4 \times 4$, and 2 that is carried is 32; that is 2 and carry 3. *Fourthly*, $5 \times 4 + 2 \times 2 + 3 \times 4 + 4 \times 2$, and 3 that is carried is 47; set down 7 and carry 4. *Fifthly*, $3 \times 4 + 5 \times 2 + 2 \times 4 + 3 \times 2 + 4 \times 5$, and 4 that is carried is 60; set down 0 and carry 6. *Sixthly*, $3 \times 2 + 5 \times 4 + 2 \times 2 + 3 \times 5$, and 6 that is carried is 51; set down 1 and carry 5. *Seventhly*, $3 \times 4 + 5 \times 2 + 2 \times 5$, and 5 that is carried is 37; that is 7 and carry 3. *Eighthly*, $3 \times 2 + 5 \times 5$, and 3 that is carried is 34; set down 4 and carry 3. *Lastly*, 3×5 , and 3 that is carried is 18; which being multiplied by the last figure in the multiplier, set the whole down and the work is finished.

PART V.

THE MENSURATION OF CIRCLES, &c.

BEFORE we proceed to the solutions of these problems, we shall put d = the diameter, p = the periphery, and a = the area, then will the following theorems solve all the possible cases that can be proposed about the circle.

- | | |
|---|----------------------------|
| I. $a = \frac{1}{2}d \times \frac{1}{2}p$. | IV. $a = 0,7854dd$. |
| II. $p = 3,1416d$. | V. $a = 0,0795776pp$. |
| III. $d = 0,3183p$. | VI. $d = \sqrt{1,2732a}$. |
| VII. $\sqrt{12,5664a} = p$. | |

(¹) By the first theorem $\frac{22,6}{2} \times \frac{71}{2} = \frac{1604,6}{4} = 401,15$, the answer required.

(²) By the second theorem $3,1416 \times 22,6 = 71,00016$, the circumference required.

(³) By the third theorem $0,3183 \times 71 = 22,5993$, the diameter required.

(⁴) By the fourth theorem $0,7854 \times 22,6^2 = 401,150904$, the area required.

(⁵) By the fifth theorem $0,0795776 \times 71^2 = 401,1506818$, the area required.

(⁶) If the diameter of a circle be r , the side of a square equal thereto, says our author, in his prefatory remarks to this part, will be $0,8862$. Therefore as $1:0,8862::22,6:20,02812$ the side of the square required.

(7) By

(7) By our author's remarks as before, we have as $1:0,2821::71:20,029$ the side of the square required.

(8) As $1:0,7071::22,6:15,9804$ the side of the inscribed square required.

(9) As $1:0,2751::71:15,9821$ the side of the inscribed square required.

(10) By the sixth theorem $\sqrt{1,2732 \times 401,15} = 22,599$ the diameter required.

(11) By the seventh theorem $\sqrt{12,5664 \times 401,15} = 71$ the circumference required.

(12) By the before-said remarks, we have, as $1:401,15::0,6366:255,372090$, whence $\sqrt{255,372090} = 15,98$ the side of the inscribed square required.

(13) As $1:1,4142::15,98:22,598916$ the diameter required.

(14) As $1:1,128::20,0291:22,5928248$ the diameter required.

(15) As $1:4,443::15,98:70,99914$ the circumference required.

(16) As $1:3,545::20,0291:71,0041595$ the circumference required.

PART

END

PART VI.

SOLUTIONS to the promiscuous QUESTIONS.

(1) Here $2502205 =$ to the answer required.

(2) Here $254 \times 14 \times 4\frac{1}{2}d. = 16002d. = 66l. 13s. 6d. \text{ Ans.}$

(3) As $5l. : 100l. :: 20l. : \frac{20 \times 100}{5}$, again as $12 \text{ mo.} : \frac{20 \times 100}{5}$

$7\frac{1}{2} \text{ mo.} : \frac{20 \times 100 \times 12}{5 \times 8} = 100 \times 6 = 600l. \text{ Ans.}$

(4) First $14^2 = 196$, and $12^2 = 144$, then $250 + 196 - 144 = 302 \text{ Ans.}$

(5) Here $\left. \begin{array}{l} 320 \times 5 \\ 460 \times 3 \end{array} \right\} = \left\{ \begin{array}{l} 1600 \\ 1380 \end{array} \right\} = \left\{ \begin{array}{l} A's \\ B's \end{array} \right\} \text{ Stock } \times \text{ ed in-}$
 $2980 \text{ the sum of the products.}$
 to his time.

Then as $2980 : 100l. :: \left\{ \begin{array}{l} 1600 : 53 \frac{13}{100} \\ 1380 : 46 \frac{6}{100} \end{array} \right\} \frac{9\frac{270}{98} = A's}{2\frac{28}{98} = B's} \text{ gain.}$
 $100 \quad 0 \quad 0 \text{ proof.}$

(6) First $13 \text{ cwt. } 2 \text{ qrs.} = 1512 \text{ lb.}$ then $1512 \times 14d. = 21168d.$ the price of the wool; again, as $210d. (= 17s. 6d.) : 1 \text{ yd.} :: 21168d. : 100 \text{ yds. } 3\frac{1}{3} \text{ qrs.} \text{ Ans.}$

(7) First $21^3 = 9261$, and $113 \times 147 = 16611$, then $16611 - 9261 = 7350, \text{ Ans.}$

(8) First $90l. + 10l. = 100l.$ then as $1000 \times 3 \text{ qrs.} : 100l. :: 5 \text{ qrs.} : 3s. 4d. \text{ Ans.}$

(9) First

(⁹) First as $14s. : 16s. :: 42l. : 48l.$ the advanced price of one tun of B's wine; again, $648 \times 16s. = 10368s.$ the advanced value of A's cloth, then as $960s. = (48l.) : 1 \text{ tun.} ::$

$$10368s. : \frac{10368}{960} = 10 \text{ tun. } 3 \text{ bds. } 12\frac{3}{4} \text{ gals. } \text{Ans.}$$

(¹⁰) First $876 \times 16\frac{1}{2}s. = 14454s. = 722l. 14s.$ then $1200l. = 722l. 14s. = 477l. 6s. \text{Ans.}$

cut. qr. lb. lb.

(¹¹) First $417 \text{ lb. } 15 = 46747$ the gross weight
From which deduct 8347 the tare.
Diff. $38400 =$ the neat, which divided by $7\frac{1}{2} \text{ lb.}$ will give $5120 \text{ gals. } \text{Ans.}$

(¹²) First $240l. - 180l. = 60l.$ gain by the bargain; then we have as $180l. : 60l. :: 240l. : 80l.$ gain upon the latter sale, whence $240l. + 80l. = 320l. \text{Ans.}$

(¹³) First $54^2 = 2916$, and $46 + 19 = 874$, then $2916 - 874 = 2042$, the number required.

(¹⁴) As $174d. : 201d. :: 100l. : 115l. 10s. 4\frac{1}{4}d.$ from which subtract $100l.$ and the remainder is $15l. 10s. 4\frac{1}{4}d.$ the gain per cent.

lb. lb.

(¹⁵) First $84.75 \times 27 = 2288.25$ the gross weight.
and $1.375 \times 27 = 37.125$ the tare.
 $\frac{1}{28} 2251.125$ futtle.
 86.5817 tret.

diff. 2164.5433 neat, which at $8\frac{1}{2}d.$ per lb. comes to $18398.618d. = 76l. 13s. 2\frac{1}{2}d. \text{Ans.}$

(¹⁶) If $\frac{2}{3} \text{ oz.} : \frac{7}{8}l. :: \frac{5}{6} \times \frac{16}{1} \text{ oz.} : \frac{3 \times 7 \times 5 \times 16}{2 \times 8 \times 6 \times 1} = \frac{7 \times 5}{2 \times 1} = \frac{35}{2} = 17s. 6d. \text{Ans.}$

(¹⁷) If $\frac{5}{6} \text{ gals.} : \frac{5}{8}l. :: \frac{5}{9} \times \frac{25}{1} \text{ gal.} : \frac{6 \times 5 \times 5 \times 25}{5 \times 8 \times 9 \times 1} = \frac{2 \times 5 \times 25}{8 \times 3} = \frac{250}{24} = 10\frac{5}{6}l. \text{Ans.}$

(¹⁸) First

(¹⁸) First $210 \div \frac{2}{3} = 315$ *l.* the eldest brother's portion, whence $315 \times 6 = 1890$ *l.* the father's estate.

(¹⁹) As 365 *d.* : 48 *l.* :: 232 *d.* : $\frac{232 \times 48}{365} = 30$ *l.* 10 *s.*
 $2\frac{1}{2}$ *d.* + the *Ans.*

(²⁰) If 1 *d.* : $1,39375$ *l.* :: 365 *d.* : $508,71875$ *l.* then $508,71875$ *l.* + 340 *l.* = $848,71875$ *l.* = 848 *l.* 14 *s.* $4\frac{1}{2}$ *d.* *Ans.*

(²¹) First $16 \times 2 = 32$, the number of partitions, then $37,5$ *l.* $\times 32 = 1200$ *l.* hence 1200 *l.* + 200 *l.* = 1400 *l.* the lady's portion.

(²²) First $13 \times 19,5 \times 112 = 28392 = 454272$ *lb.* *oz.*
 and $39 \times 388 = 15132 = 242112$
 diff. 212160 *Ans.*

(²³) First 1360 *l.* $\div 5 = 272$ *l.* the captain's share, and $1360 - 272 \div 160 = 6$ *l.* 16 *s.* each sailor's share.

(²⁴) First $12\frac{1}{2} = 12\frac{3}{2}$, and secondly $7\frac{3}{2} = 7\frac{8}{2}$, whence $12\frac{3}{2} - 7\frac{8}{2} = 4\frac{7}{2}$, the number required.

(²⁵) First 81 *l.* - 75 *l.* = 6 *l.* the interest of 75 *l.* for one year, whence we have as 75 *l.* : 6 *l.* :: 100 *l.* : 8 *l.* the *Ans.*

(²⁶) First 956 *l.* $\times 7,5 \times ,05 = 358,5$ *l.* the interest for the given time, whence 956 *l.* + 358 *l.* 10 *s.* = 1314 *l.* 10 *s.* the amount required.

(²⁷) By theorem the 4th of Simple Interest, we have $\frac{1314,5 - 956}{956 \times 7,5} = ,05$, or 5 *l.* the rate per cent.

(²⁸) If 36 *m.* : 1200 *lb.* :: 24 *m.* : $\frac{1200 \times 36}{24} = 1800$ *lb.*
 the *Ans.*

(²⁹) If 8 *can.* : 48 *bar.* :: 24 *can.* : 144 *bar.* again, as 1 *d.* : 144 *bar.* :: 22 *d.* : 3168 *bar.* the *Ans.*

(³⁰) Any

(38) As 1 mo. : 360 m. :: 5 mo. : 72, the number of men, the remaining 1 month's provisions will serve 5 months, whence $360 - 72 = 288$, the number that must depart out.

(39) First $187 + 34 = 221$, the greater number; then $187 \times 221 = 41327$ the product, whence $41327^2 = 1707920929$ the square of the product.

(40) First $216l. = 4320s.$ the dividend,

$$\begin{array}{r} \text{then } \begin{array}{r} \text{£} \quad \text{s.} \quad \text{s.} \\ 11 \quad 0 = 220 \\ \quad \quad 40 \\ 1 \quad 5 = 25 \\ 1 \quad 15 = 35 \\ \hline 321 \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \text{price of } \begin{cases} \text{an Ox.} \\ \text{a Cow.} \\ \text{a Colt.} \\ \text{a Hog.} \end{cases} \end{array}$$

321 sum = the divisor,

whence $4320 \div 32 = 131$ of each sort and 8l. over.

(41) First $11\frac{5}{7} = 11\frac{44}{56}$, then $36\frac{33}{56} - 11\frac{44}{56} = 24\frac{51}{56}$, the *Ans.*

(42) First $11\frac{2}{7} = 1\frac{9}{7}$, then $1\frac{9}{7} \div \frac{3}{7} = 1\frac{37}{7} = 26\frac{4}{7}$, *Ans.*

(43) By theorem 2 of Arithmetical Progression, we have $58 - 3 \div 12 - 1 = 5$ years the common difference required.

(44) First $13 \text{ cwt.} \times 41 = 533 \text{ cwt.}$ the value of one hogl. head, then $7179 \times 533 = 3826407s. = 191320l. 7s.$ the *Ans.*

(45) First $500l. 13s. 6d. \times 3\frac{1}{2} = 1752l. 7s. 3d.$ then $1752l. 7s. 3d. \div 100 = 17l. 10s. 5\frac{1}{2}d. - \frac{68}{100}$, the commission required.

(46) First $15000l. - 13200l. = 1800l.$ what Charlotte had left by the old lady, and $20000l. - 13200l. = 6800l.$ what Kitty had left by the same lady; whence $6800l. + 1800l. = 8600l.$ the whole sum the old lady left them.

(47) By the snail going up 8 feet every day, and coming down half that number every night, it is evident that at the morning of the fourth day the snail must be 12 feet from the bottom, therefore at the evening of the same day the snail must arrive at the top.

(48) This

(⁴⁸) This is properly a question in the Double Rule of Three in Vulgar Fractions, but may be done much more easily and expeditiously, thus, if 2, which is the one-third of 6, be increased to 3, what will 5, which is the one-fourth of 20, be increased to in the same proportion. *Ans.* $7\frac{1}{2}$.

(⁴⁹) The one-fourth of 14676 is 3669, whence $14676 - 3669 = 11007$, the *Ans.*

(⁵⁰) First $461l. + 581l. = 1042l.$ then $1468l. - 1042l. = 426l.$ the *Ans.*

(⁵¹) First 3 *grs.* 14 *lb.* = 98 *lb.* then $98 \div 112 = .875$, the decimal required.

(⁵²) First $60 \times 104d. = 6240d.$ the value of the inkle, then $6240 \div 4\frac{1}{2} = 1386\frac{2}{3}$ pounds of sugar, the *Ans.*

(⁵³) As $9d. : 4\frac{1}{2}d. :: 100l. : \frac{9 \times 100}{9 \times 2} = 50l.$ which will be equal to the loss per cent.

	<i>lb.</i>	<i>d.</i>	
(⁵⁴) Here	$20 \times 9 = 180$		} value of the different mixtures.
	$60 \times 12 = 720$		
	$40 \times 18 = 720$		
	$12 \times 24 = 288$		
	<hr/> 132	<hr/> 1908	($14\frac{1}{4}d. - \frac{9}{11}$ the value of a lb. of this mixture.

(⁵⁵) First $254 \times 4\frac{1}{2}d. = 1143d.$ the value of one barrel, then $1143d. \times 14 = 16002d. = 66l. 13s. 6d.$ the value req.

(⁵⁶) Here $2173l. + 371l. = 2544l. = B's$ debt required.

(⁵⁷) First $28 \times 2 = 56$, twice twenty-eight, and $8 \times 2 + 20 = 36$, twice eight and twenty, then $56 - 36 = 20$, their difference; again $55 \times 2 = 110$, twice fifty-five, and $5 \times 2 + 50 = 60$, twice five and fifty, then $110 - 60 = 50$, the second difference.

(⁵⁸) First $54^2 = 2916$, and $46 \times 19 = 874$, then $2916 - 874 = 2042$, the number required.

(⁵⁹) Suppose he had 4 scholars,

Then as many 4

Half as many 2

And one quar- } 1

ter as many } 1

As sum $11 : 99 :: 4 : \frac{99 \times 4}{11} = 36$, the num-

ber he had.

(⁶⁰) In this question we have given the first term, the common difference, and the number of terms of an Arithmetical Progression to find the last term, thus $9 \times 3 - 3 + 1 = 25$, which are the number of years, more by one than the lady was in bearing her children, whence $24 + 19 + 19 = 62$ years, the lady's age.

(⁶¹) Here $705 - 168 = 538$, the number required.

(⁶²) Here $100l. - 70l. = 30l.$ the sum that's due to the maid.

(⁶³) As $4s. : 18 lb. :: 6s. : \frac{4 \times 18}{6} = 12 lb.$ the *Ans.*

(⁶⁴) A noble and a mark are $= 13s. 4d. + 6s. 8d. = 20s.$ then as $20s. : 15 yds. :: 1000s. = (50l.) : 750 yds.$ and $\frac{750 \times 4}{5} = 600$ English ells.

(⁶⁵) Here $650l. \times 400 \div 100 = 2600l.$ and $1300l. \times 400 \div 100 = 520l.$ then $2600l. - 520l. = 2080l.$ the whole loss.

(⁶⁶) First $4429 \div 43 = 103$, and then $240 - 103 = 137$, the number required.

(⁶⁷) First $2262 \div 26 = 87$, and then $2262 \div 87$ must leave 26, whence $87 - 26 = 61$, the number required.

(⁶⁸) Here $17 + 8 + 46 + 20 \times 2 = 111$ years, the father's age at the time of his death.

(⁶⁹) First

(69) First as $6s. : 6.5s. :: 9d. : 9\frac{1}{2}d.$ the advanced price of the cotton; again as $1 doz. : 6.5s. :: 100 doz. : 650s.$ the advanced value of the candles in barter; and lastly, as $9.75d. : 1 lb. :: 7800d. = (650s.) : 800 lb. = 7 cwt. 0 qr. 16 lb.$ the quantity of cotton that must be given for the hundred dozen of candles in barter.

(70) First $360 - 114 = 246$; the greater number, then $246 - 114 = 132$ their difference, $246 \times 114 = 28044$ their product, and $246 \div 114 = 2\frac{3}{5}$, the quotient of the greater being divided by the less.

(71) As the brigade consists of 384 men, and there are to be 32 men in front, therefore $384 \div 32 = 12$, the number of ranks.

(72) First $73l. is = 1460s.$ then $1460s. \div 365 = 4s.$ the *Ans.*

(73) Here as $53l. : 70d. :: 100l. : \frac{70 \times 100}{53} = 132d. \frac{4}{3} = 11s. \frac{4}{3}$, what C ought to pay.

(74) First $100 yds. \div 3 = 33\frac{1}{3}s.$ and $100 yds. \div 2 = 50s.$ then $50s. + 33\frac{1}{3}s. = 83\frac{1}{3}s.$ what the two lots of ribbanding were bought for; again, as $5 yds. : 2s. :: 200 yds. : 80s.$ what the ribbanding was sold for, whence $83\frac{1}{3}s. - 80s. = 3\frac{1}{3}s. = 3s. 4d.$ the sum lost by the bargain.

(75) Here the $\frac{5}{8}$ of $20s.$ is $= 20 \times 5 \div 8 = 12s. 6d.$ the *Ans.*

(76) Here $\frac{3}{5}$ added to $\frac{1}{8}$ is $= \frac{24}{40} + \frac{5}{40} = \frac{29}{40}$, the number req.

(77) As the money is worth seven times as much as the purse, therefore $12s. 8d. \div 8 = 1s. 7d.$ the value of the purse, hence $12s. 8d. - 1s. 7d. = 11s. 1d.$ the sum in the purse.

(78) Here $9 \times 3 \div 2 = 13\frac{1}{2}$, the number sought.

(79) First $4s. 6d. + 4s. + 3s. 6d. = 12s.$ then $12 \div 3 = 4s.$ the value of a bushel of the mixture.

(80) Here $30 \begin{array}{|l} 48 \\ 36 \\ 24 \end{array} \left| \begin{array}{l} 6 \\ 6 \\ 18+6 \end{array} \right. \begin{array}{|l} 6 \\ 6 \\ 24 \end{array} \left. \vphantom{\begin{array}{|l} 48 \\ 36 \\ 24 \end{array}} \right\} \text{the quantities of each sort respectively.}$
T 2

(81) The

(⁸¹) The worth of the ship is thus found, $3740l. \times 8 \div 3 = 9973l. 6s. 8d.$ the worth required.

(⁸²) As the first child was born when the father was 24 years old, therefore $19 \times 1\frac{1}{2} = 28\frac{1}{2}$, the time between the birth of the eldest and youngest, whence $24 + 28\frac{1}{2} + 21 = 73\frac{1}{2}$, the father's age.

(⁸³) As $5\frac{1}{3}s. : 1 gal. :: 1248s = (62l. 8s.) : \frac{1248 \times 3}{16} = 234 gals.$ the *Ans.*

(⁸⁴) As $1l. : 7.5s. :: 296.85l. : 296.85 \times 7.5 = 2226.375s. = 111l. 6s. 4\frac{1}{2}d.$ the sum C receives for his debt.

(⁸⁵) First $190l. 12s. = 11436 groats$, then we have as $11 groats : 1 p. :: 11436 groats : 1039\frac{7}{11}p. = 86 doz. 7\frac{7}{11}p.$ the *Ans.*

(⁸⁶) Suppose there were 27 sheep in the fold at first, then the half thereof plus half a sheep is $= 13\frac{1}{2} + \frac{1}{2} = 14$, whence $27 - 14 = 13$, the number left after the first theft, proceeding in the same manner through the other two nights, there will be left but $2\frac{1}{2}$ at the last, therefore $20 - 2\frac{1}{2} = 17\frac{1}{2}$, the first error in defect.

Again, suppose there were 47 in the fold at first, then the half thereof plus half a sheep is $= 23\frac{1}{2} + \frac{1}{2} = 24$, whence $47 - 24 = 23$, the number left after the first theft, proceeding as before there will be left but 5 at the last, therefore $20 - 5 = 15$, the second error in defect; here the errors are of alike kind, whence by the rule of Double Position $\frac{17.5 \times 47 - 15 \times 27}{17.5 - 15} = 167$, the number of sheep at the first.

(⁸⁷) In a ton are 20 *cwt.* therefore $20 \times 3 = 60 cwt.$ the weight of the whole club, and $60 cwt. \div 15 = 4 cwt.$ the weight of each.

(⁸⁸) Suppose

(⁸⁸) Suppose his fortune £. 20000
 $\frac{1}{3}$ th part deduct 4000
 What left 16000
 Value of his commission sub. 2200
 What left 13800

2|0)4140|0

What left 2070
 Deduct 880 guineas = 924
 Error in excess 1146

Again suppose his fortune 10000
 $\frac{1}{3}$ th part deduct 2000
 What left 8000
 Value of his commission sub. 2200
 What left 5800

2|0)1740|0
 870

Then $924 - 870 = 54$ error in defect, whence by the rule of
 Double Position $\frac{1146 \times 10000 + 54 \times 20000}{1146 + 54} = 10450$ l. his
 fortune at first.

(⁸⁹) First 395 l. 18 s. = 7918 s. and 100 l. 12 s. = 2012 s. then
 as 7918 s. : 2012 s. :: 20 s. : $\frac{2012 \times 20}{7918} = 5$ s. $0\frac{3}{4}$ d. $\frac{7446}{7918}$, Ans.

(⁹⁰) Here 360 guild. $\times 26 \div 52 = 180$ dollars, the Ans.

(⁹¹) The $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$ being reduced to a common denominator by Case I. of Vulgar Fractions, and then added together make $\frac{3}{4}$. Now let $\frac{4}{4} = 1$, represent the whole sum of money at first, from which take $\frac{3}{4}$ and there remains $\frac{1}{4}$ part = 28 l. therefore say as $1 : 4 :: 28$ l. : 112 l. the Ans.

(92) By Case II. of Simple Interest $1000l. \times .0475 \times 5.5 = 1261.25 = 1261l. 5s.$ the *Ans.*

(93) The amount of $100l.$ at the given rate per cent. for the time of the first payment (viz. 4 months) is $\frac{305}{3}$, then by the rule in discount, as $\frac{305}{3}l. : 100l. :: 350l. : \frac{105000}{305}l.$ the present worth of the first payment.

Again, for the second time of payment, (viz. 8 months) the amount of $100l.$ will be $\frac{310}{3}l.$ then as $\frac{310}{3}l. : 100l. :: 350l. : \frac{105000}{310}l.$ present worth of the second payment; hence $\frac{105000}{305}l. + \frac{105000}{310}l. = \frac{6457500}{94350} = 682l. 19s. 4\frac{3}{4}d.$ the *Ans.*

(94) If $30f.$ long : $18f.$ wide $:: \frac{9}{4}f. : 30 \times 18 \div \frac{9}{4} = 240 feet = 80 yds.$ the *Ans.*

(95) First $48 \times 2 = 96$ the greater number,

Then $96 + 48 = 144$ their sum.

And $96 - 48 = 48$ their difference.

Hence $\frac{96}{48}$ is the second difference.

=

(96) First $\frac{19312 \times 5}{3} = 32186l. 13s. 4d. =$ two year's rent,

then $\frac{32186l. 13s. 4d.}{2} = 16093l. 6s. 8d.$ the yearly income required.

(97) First $25^2 = 625$ the greater number, then $\sqrt{625^2 + 25^2} = 625,4998 +$ the *Ans.*

(98) Suppose B's sheep 10 and C's 18,

Then if we add $\frac{4}{4}$.

The sum will be $\frac{14}{14} = C's = 14,$

But $18 + 4$ is not $= 6 \times 2 = 12$, here the error is 10.

Again suppose B's sheep 16 and C's 24,

Then if we add

$\frac{4}{4}$

The sum will be $\frac{20}{20} = C's = 20,$

But $24 + 4$ is not $= 12 \times 2 = 24$, here the error is 4.

Here the errors are alike; whence by the rule of Double

Position $\frac{16 \times 10 - 4 \times 10}{10 - 4} = 20$ sheep, the number B had,

hence C's number was 28.

(99) First $300l. + 160l. + 140l. = 600l.$ then

$$\begin{array}{l} \text{as } \begin{array}{c} \text{£.} \quad \text{£.} \\ 600 : 120 \end{array} :: \left\{ \begin{array}{l} \text{£.} \quad \text{£.} \\ 140 : 28 \text{ B's} \\ 300 : 60 \text{ C's} \\ 160 : 32 \text{ D's} \end{array} \right\} \text{gain.} \\ \text{or, as } 5 : 1 :: \end{array}$$

(100) As the number of each are equal, therefore will

$$\frac{50 \times 12}{6+8+16} = 20, \text{ the Ans.}$$

(101) First $19^3 = 6859$, and $17^2 + 48^2 = 2593$, then $6859 - 2593 = 4266$, the difference required.

$$\begin{array}{r} \text{f. in. p.} \\ 4 \quad 6 \quad = \text{length.} \\ 2 \quad 9 \quad = \text{breadth.} \\ \hline 9 \quad 0 \\ 3 \quad 4 \quad 6 \\ \hline 12 \quad 4 \quad 6 = \text{superficies.} \end{array}$$

$$\begin{array}{r} \text{then} \quad \text{f. in. p.} \\ 12 \quad 4 \quad 6 \text{ superficies.} \\ \times \text{ ed by } 3 \quad 4 \quad 0 = \text{the depth.} \\ \hline 37 \quad 1 \quad 6 \\ 4 \quad 1 \quad 6 \\ \hline \end{array}$$

Gives $\underline{\underline{41 \quad 3 \quad 0}}$ the solidity required.

(103) First $640 \times 22\frac{1}{2} = 14400s.$ their pay per month, then $14400s. \times 32 = 460800s. = 23040l.$ the Ans.

(104) First $470l. - 130l. = 340l.$ then as $365d. : 340l. :: 1d. : 18s. 7\frac{1}{2}d. - \frac{90}{365}$, the Ans.

(105) Any quotient multiplied by its divisor will give the dividend, therefore $72 \times 19 = 1368$, the number required.

(106) Here $13\frac{1}{2} \div 36 = \frac{13 \times 2 + 1}{2 \times 36} = \frac{27}{72} = \frac{3}{8}$, the fraction required.

(107) First

(¹⁰⁷) First $28 \text{ qrs. } 2 \text{ bush.} = 226 \text{ bush.}$ then $226 \times 4\frac{1}{2} = 1017\text{s.} = 50\text{l. } 17\text{s.}$ the *Ans.*

(¹⁰⁸) First $5\text{s. } 9\text{d.} = 69\text{d.}$ and $13\text{s. } 4\text{d.} = 160\text{d.}$ then $426 \text{ lb.} \times 160\text{d.} = 68160\text{d.}$ the value of the tea; again as $69\text{d.} : 1\text{ lb.} :: 68160\text{d.} : 987\frac{5}{8}\text{ lb.}$ the coffee that's to be given in barter for the said tea.

(¹⁰⁹) Here $27 \text{ d. } 10 \text{ lb.}$ of candles $= 334 \text{ lb.}$ which at 5d. per lb. comes to $1670\text{d.} = 6\text{l. } 19\text{s. } 2\text{d.}$ the *Ans.*

(¹¹⁰) The value of 500 French crowns at $4\frac{1}{2}\text{s.}$ per crown $= 2250\text{s.}$ again a halfpenny per crown, or 500 half-pence $= 20\text{s. } 10\text{d.}$ whence $2250\text{s.} - 20\text{s. } 10\text{d.} = 2229\text{s. } 2\text{d.} = 111\text{l. } 9\text{s. } 2\text{d.}$ the sterling money he ought to receive.

(¹¹¹) First $63^2 \times 31,5^2 = 3938240,25$, the product of their squares, and $63 \times 31,5 - 63 + 31,5 = 1890$, the difference of their product and sum.

(¹¹²) From the whole gain subtract C's, thus $100\text{l.} - 60\text{l.} = 40\text{l.} = 3\text{'s}$ gain, then say as $40\text{l.} : 640\text{l.} :: 60\text{l.} : 960\text{l.}$ C's stock.

(¹¹³) As $5\text{l.} : 100\text{l.} :: 20\text{l.} : \frac{100 \times 2}{5} = 400\text{l.}$ the principal required.

(¹¹⁴) First $40 \text{ yd.} \times 8\text{s.} = 320\text{s.}$ the value of the first lot, and secondly, $70 \text{ yd.} \times 12 = 840\text{s.}$ the value of the second ditto, whence $320\text{s.} + 840\text{s.} = 1160\text{s.} = 58\text{l.}$ the *Ans.*

(¹¹⁵) First $7 \text{ m.} + 11 \text{ m.} = 18 \text{ m.}$ the distance they travel per day, then as $1 \text{ d.} : 18 \text{ m.} :: 12 \text{ d.} : 216 \text{ m.}$ the *Ans.*

(¹¹⁶) First $672 \text{ Sp. guild.} \times 2\text{s.} = 1344\text{s.}$ the value of the Spanish guilders, then as $17,5\text{s.} : 1 \text{ F. pistole} :: 1344\text{s.} : 76\frac{2}{3}\text{ F. pistols,}$ the *Ans.*

(¹¹⁷) First $1 \text{ cwt. } 2 \text{ qrs. } 5 \text{ lb.} = 44288 \text{ dr.}$ which \times ed by 7 gives 310016 dr. the weight of the seven cheeses, again $5 \text{ oz. } 7 \text{ dr.} = 87 \text{ dr.}$ a seaman's allowance, whence $310016 \div 87 = 3563\frac{3}{7}$, the number of allowances required.

(¹¹⁸) The

(118) The number required in this question is evidently equal to $48 + 72 + 19 + 7 + 12 = 158$.

(119) First the $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{7}$, when reduced to a common denominator by Case I. of Vulgar Fractions, and added together make $\frac{2754}{2520}$, then

$$\text{As } \frac{2754}{2520} : 500 :: \begin{array}{l} \frac{1}{3} : 152\frac{1392}{2520} \text{ A's} \\ \frac{1}{4} : 114\frac{1044}{2520} \text{ B's} \\ \frac{1}{5} : 91\frac{1386}{2520} \text{ C's} \\ \frac{1}{6} : 76\frac{696}{2520} \text{ D's} \\ \frac{1}{7} : 65\frac{90}{2520} \text{ E's} \end{array} \text{ share.}$$

(120) Suppose the man was 12 years of age, then must the woman have been 36; and by the second conditions of the question, we have as $1 : 2 :: 22\frac{1}{2} : 45$ which should have been $46\frac{1}{2}$, therefore the error is $1\frac{1}{2}$.

Again, suppose the man was 10 years of age, then must the woman have been 30; and by the second conditions of the questions, we have as $1 : 2 :: 20\frac{1}{2} : 41$, which should have been $40\frac{1}{2}$, therefore the error is $\frac{1}{2}$; here the errors are

unlike, whence by the rule of Double Position $\frac{1\frac{1}{2} \times 10 + \frac{1}{2} \times 12}{1\frac{1}{2} + \frac{1}{2}} = 10\frac{1}{2}$ yrs. the man's age, hence the woman's age is $31\frac{1}{2}$ years.

(121) If 12 oxen in 4 weeks eat up $3\frac{1}{2}$ acres, then by proportion 36 oxen in 4 weeks, or 16 oxen in 9 weeks, or 8 oxen in 18 weeks, will eat up 10 acres, on supposition that the grass did not grow. But since by reason of the growth of the grass 21 oxen in 9 weeks can eat up only 10 acres, that growth of the grass in 10 acres for the last 5 weeks will be as much as would be sufficient to feed the excess of 21 oxen above 16, that is 5 oxen for 9 weeks; or, what is the same thing, to feed $\frac{5}{2}$ oxen for 18 weeks. And in 14 weeks (the excess of 18 above the first 4) the increase of the grass, by analogy, will be such as to be sufficient to feed 7 oxen for 18 weeks; for it is as 5 weeks : 14 weeks :: $\frac{5}{2}$ oxen : 7 oxen. Wherefore add these 7 oxen, which the growth of the grass alone would suffice to feed, to the 8, which the grass without growth after 4 weeks would feed, and the sum will be 15 oxen. And lastly, if 10 acres suffice to feed 15 oxen for 18 weeks, then in proportion 24 acres would suffice 36 oxen for the same time.

(¹¹¹) Suppose the lady's age 14, then by the conditions of the question $14 \times 3 \times \frac{2}{7} \times 3 \times \frac{2}{3} = 8$, but should have been equal to 16, therefore the error is 8 in defect.

Again, suppose the lady's 21, then by the conditions of the question $21 \times 3 \times \frac{2}{7} \times 3 \times \frac{2}{3} = 12$, but should have been equal to 16, therefore the error is 4 in defect, whence by the rule in Double Position $\frac{8 \times 21 - 4 \times 14}{8 - 4} = 28$, the lady's age req.

Thus having gone through the Miscellaneous Questions, we proceed to the solutions of the remaining questions, about Interest, &c. by our author's table.

1. To find the interest of any sum of money for any number of months, weeks, or days, at any rate per cent. by the table.

£. s.	then	£. s. d.	
(¹) 2467 10		900 = 75	0
4		80 = 6 13	4
9870 0		7 = 0 11	8
10		987 82 5	0 the interest req.
987100			

£. s.	then	£. s. d.	
(²) 2467 10	1000 = 19 4	7 $\frac{1}{2}$	
5	400 = 7 13	10	
12337 10	80 = 1 10	9 $\frac{1}{2}$	
12	50 = 0 0	2 $\frac{1}{2}$	
148050 0	148050 = 28 9	4 $\frac{3}{4}$	the int. req.

£. s.	then	£. s. d.	
(³) 2467 10	7000 = 19 3	6 $\frac{1}{2}$	
6	400 = 1 11	11	
14805 0	2 = 0 0	1 $\frac{1}{2}$	
50	50 = 0 0	0 $\frac{1}{2}$	
740250	740250 = 20 5	7	the int. req.

2. To find what an estate from 1l. to 60,000l. per annum, will come to for one day.

$$\begin{array}{r}
 \text{£. s. d.} \\
 (4) \quad 300 = 0 \quad 16 \quad 5\frac{1}{4} \\
 \quad \quad 70 = 0 \quad 3 \quad 10 \\
 \quad \quad 6 = 0 \quad 0 \quad 4 \\
 \hline
 376 \quad \underline{\underline{1 \quad 0 \quad 7\frac{1}{4}}} \text{ Ans.}
 \end{array}$$

3. To find the amount of an income, salary, or servants' wages, for any number of months, weeks, or days.

For 11 months.

$$\begin{array}{r}
 \text{£.} \quad \text{£. s. d.} \\
 (5) \quad 270 \quad 2000 = 166 \quad 13 \quad 4 \\
 \quad \quad 11 \quad 900 = 75 \quad 0 \quad 0 \\
 \quad \quad \quad 70 = 5 \quad 16 \quad 8 \\
 \hline
 2970 \quad \underline{\quad} \\
 2970 = 247 \quad 10 \quad 0
 \end{array}$$

For 3 weeks.

$$\begin{array}{r}
 \text{£.} \quad \text{£. s. d.} \\
 270 \quad 800 = 15 \quad 7 \quad 8\frac{1}{2} \\
 \quad \quad 3 \quad 10 = 0 \quad 3 \quad 10\frac{1}{4} \\
 \hline
 810 \quad 810 = 15 \quad 11 \quad 6\frac{1}{2}
 \end{array}$$

For 6 days.

$$\begin{array}{r}
 \text{£.} \quad \text{£. s. d.} \\
 270 \quad 1000 = 2 \quad 14 \quad 9\frac{1}{2} \\
 \quad \quad 6 \quad 600 = 1 \quad 12 \quad 10\frac{1}{2} \\
 \quad \quad \quad 20 = 0 \quad 1 \quad 1\frac{1}{4} \\
 \hline
 1620 \quad 1620 = 4 \quad 8 \quad 9\frac{1}{4}
 \end{array}$$

For the whole time:

$$\begin{array}{r}
 \text{£. s. d.} \\
 247 \quad 10 \quad 0 \\
 \quad 15 \quad 11 \quad 6\frac{1}{2} \\
 \quad \quad 4 \quad 8 \quad 9\frac{1}{4} \\
 \hline
 267 \quad 10 \quad 3\frac{3}{4} \text{ Ans.}
 \end{array}$$

FINIS.

